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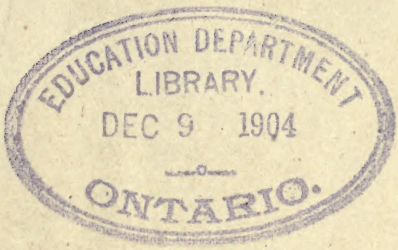

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Willard School Flower-Show, Cleveland, Ohio.

CHILDREN'S GARDENS

FOR SCHOOL AND HOME

A MANUAL OF COOPERATIVE GARDENING

BY

LOUISE KLEIN MILLER

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TO

MY MOTHER, ANN MILLER

WHO FOR NINETY YEARS LOVED FLOWERS FED THE BIRDS, WAS KIND TO ANIMALS, THIS VOLUME IS MOST AFFECTIONATELY DEDICATED

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PREFACE

Cooperative gardening is one of the newer movements for the education of the young and for the elevation of neglected and unfortunate classes; yet it has already become an important factor in the school and home life of many places under the auspices of school authorities, civic leagues, improvement associations, women's clubs, settlement houses, libraries and other bodies.

This movement has two motives—the transforming of barren, dreary, ill-kept school grounds and other uncared-for public places into bowers of beauty and good taste, and developing in children love of Nature, appreciation of her beauties and ability to enhance for their own enjoyment and the public good the æsthetic effect of their immediate surroundings.

This book has been written especially in the interest of children's gardens, but it contains much that may prove of value to all who care for this noble art. It is believed that it will be especially valuable in showing what can be accomplished by a slight expenditure of time, money

and energy, with a display of good taste, toward turning the waste places of the earth into spots of beauty and wholesome influence.

The author writes in the full confidence that her many years of experience, both within and without the schoolroom, as teacher, Supervisor of Nature Study, Director of a School of Horticulture and Landscape Gardening for Women, and Supervisor of Children's Gardens have qualified her to be of assistance to those who are desirous of making gardens, but who may not have had the technical training necessary to secure the best results with the least effort.

The author desires to express her appreciation of assistance and courtesy extended to her by Dr. William T. Harris, United States Commissioner of Education, for data of the history of school gardens in Europe; Mr. William P. Rich, Secretary of the Massachusetts Horticultural Society, for reports on the school-garden movement in the United States and West Indies; Mr. A. H. Mackay, Superintendent of Education, Halifax, for information regarding the progress of work in Nova Scotia and Canada; Miss Mary L. Gardner, for description of the Kamehameha School in Honolulu; Prof. Alfred R. Rehder, of the Arnold Arboretum, Boston, for photographs of trees and shrubs.

She is indebted to Dr. James H. Canfield,

Librarian of Columbia University Library, for the courtesies of the library; Dr. D. T. MacDougal, Director of the Laboratories of the New York Botanical Gardens, Bronx Park, for privileges of the museum and conservatories; Siebrecht & Sons, New York, for valuable suggestions on window-gardening; Dr. Sylvester D. Judd, Biological Survey of the United States Department of Agriculture, for permission to quote copiously from his report on Food of Nestling Birds; Prof. John G. Jack, of the Arnold Arboretum, for valuable suggestions, and characteristics of trees and shrubs; Miss Amy Schüssler, head teacher of Speyer School, New York, for practical suggestions.

The author desires especially to acknowledge her indebtedness to the following books of reference: Sargent's, The Silva of North America; Bailey's Cyclopedia of American Horticulture; Gray's Manual of Botany; Harriet L. Keeler's Our Native Trees and Our Native Shrubs; the magazine, Garden and Forest; reports of the United States Department of Agriculture; and King's Soil.

The thanks of the author are extended to the following for use of photographs for purposes of illustration: Board of Education, New York, for A Roof Playground, Public School 153, Bronx, and two views of the Children's School-

Farm, DeWitt Clinton Park; Agricultural Experiment Station of the University of Minnesota, for cuts of grafting, cuttings and seed testing; Mrs. Elizabeth Rafter, for illustrations of Children's Home Gardening, and an experiment garden, Washington, D. C.; Peter Henderson & Co., New York, for privilege of photographing tools; Mr. John H. Patterson for views and data of the National Cash Register garden; Miss Elizabeth Seward Hill, for photographs and assistance in the Boys' Garden, Groton, Mass.; Mr. J. Boltman, New York, for the photograph of A Sociological Problem.

The author is indebted to Mr. E. W. Haines, President of the Home Gardening Association of Cleveland, Ohio, for photographs and reports of work done in Cleveland; to Park and Cemetery for privilege of reprinting the chapter, "Improvement of School Grounds."

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CHILDREN'S GARDENS

CHAPTER I

SCHOOL GARDENS A FACTOR IN EDUCATION

A FARMER in New England being remonstrated with because he had placed a barn in such a position as to obscure a magnificent view, indignantly replied, "That barn was built before the view was discovered."

Many features of our educational systems, rigid, angular, unattractive, and not educative, have been so set before the eyes and minds of children that they have effectually obscured the beauty and holiness of God's truth. Fortunately, at last the view has been discovered, and old systems are gradually falling to decay or are being broken down by those who believe that education is *life* instead of a preparation for living.

Manual training, domestic science, art, and music have broadened the vision, have given dexterity and skill, have implanted ideas of

better home conditions, and have created appreciation of the beautiful in art and a love of harmony. Nature study has opened the minds and hearts of children to the beauties and wonders of creation and has exerted an uplifting mental, moral, and spiritual influence. It has been the forerunner of a movement of deep significance and broad scope.

School Gardens.—This is not a new phase of education, but an old one gaining the recognition and support its importance merits. The gardens of Europe are far in advance of ours in comprehensiveness and efficiency, but conditions there differ greatly from those in this country. We have our own problems to solve, numerous and varied.

Many progressive persons, realizing the benefits and importance of this movement, have risen to the situation with Western push and enthusiasm, and children's gardens may be found in all sections of this country. It has not been deemed expedient or feasible to incorporate them in the regular curriculum of school work, but these gardens are now being carried on under the auspices of a few schools, civic leagues, village improvement associations, factories, settlement houses, and various other agencies.

The theory and practise of school gardens seek to reach and help two classes of children—

those who live in the city and have little opportunity of coming in contact with the things of the country, which are in consequence entirely unknown to them, and those who, while living in rural and village districts, are often ignorant

Ignorant of Nature: A Sociological Problem.

of the processes of nature with which they come in daily contact.

The first problem has a sociological and economic significance; it teaches children to become producers as well as consumers, and has a tendency to turn the tide of population toward

the country, thus relieving the congested conditions of the city. Interest in growing things must first be created, or the country will have no attraction. Without school gardens, children of the city are deprived of that which every one needs, contact with the soil.

A clergyman in one of the slum districts of New York City said his congregation was constantly changing, that as soon as the people learned a better way of living they moved to the suburbs, where they could have a little plot of ground. The late Mrs. Alice Freeman Palmer was instrumental in securing a place in the country for a poor woman and her large family of children. She was well settled, but in a short time she moved back, bag and baggage, giving as her reason, "I likes peoples better'n stumps!"

The prosperity of our country is largely dependent upon the success or the failure of our agricultural and horticultural products. In order to succeed, a farmer must work along intensive and scientific lines. If the children of our village and rural schools are to become the farmers and fruit-growers of the future, is it not important that they should have some knowledge of the things with which they come in daily contact, and upon which their future success depends? Such education will have a

tendency to make children better satisfied with country life, and to induce them to stay on the farm in peace and contentment instead of drifting to the city.

Gardening is essentially practical. There is nothing better fitted for the healthful development of children. It affords opportunity for spontaneous activity in the open air, and possibilities for acquiring a fund of interesting and related information; it engenders habits of thrift and economy; develops individual responsibility, and respect for the rights of others; requires regularity, punctuality, and constancy of purpose.

Planning the Work.—The question of space is a serious one. A plot of ground two by four feet, or three by six feet, is not calculated to satisfy the ambition of an ordinary child, but it is better than nothing. Each school should be supplied with space for a lawn, a wild garden, a small formal garden, a nursery of trees and shrubs, a vegetable garden, and a small glass-house, besides the playground. When ample provision for these has been made, and the practical work is under the direction of a trained supervisor, it can be properly systematized and graded, stated periods of the school-time being set apart for regular work in the garden.

Planting the seeds in the vegetable garden

and watching them develop would afford the primary children the greatest pleasure and profit.

The collecting instinct being strong in children of the third and fourth grades, the making

Rhododendron: Garden Hybrid.

of the wild garden will be profitable to them. As far as possible the flora of the region should be represented by a specimen of each variety, arranged in systematic order. When the plants multiply, the children can start their own wild gardens instead of taking plants from their native haunts, from which some of the rare species are rapidly disappearing.

Children of the fifth and sixth grades are more practical in their interests, and like to see

results, hence the making of the formal garden may well be intrusted to their care. This will afford an opportunity for studying the habits of growth of annuals, biennials, and perennials, for the arrangement of plants so as to produce a succession of blooming; for harmonious effects in texture of foliage and flower coloring; for the division of plants and their propagation by cuttings for repotting and other practical work in the greenhouse.

The work of the primary grades and lower grammar grades affords the children a fine

Azalea vaseyi: Azalea.

opportunity for observation and experience. Knowledge gained in this way is the basis for generalization and classification.

The Nursery.—The nursery, containing specimens of the most common native trees and shrubs, arranged according to a systematic classification, could be well managed by the students of the senior grades. Lessons in propagation by cuttings, top grafting, root grafting, budding, transplanting, would enable them to improve and increase their stock. As soon as the trees and shrubs are ready to be removed from the nursery, the students should have charge of their culture and distribution, of the replanting of seeds, and of the making of hardwood cuttings for the greenhouse. The improvement and care of school grounds should come under their direction. Instruction should include making and caring for lawns, setting of hedges, planting of shrub borders, transplanting and trimming of trees and shrubs.

Children should be taught to appreciate the beauty of common things. How few persons realize the decorative possibilities of our native *Viburnums, Cornels, Azaleas, Kalmias* and *Rhododendrons,* and the many other attractive native shrubs. After the trees and shrubs have served their purpose in the nursery, they could be transplanted by the children to their homes. With what pleasure they would care for a young Oak, Maple or *Viburnum* they had seen developing in the nursery. The influence of

this work would undoubtedly be felt in every home. It is unnecessary to say that only the

Viburnum dilatatum.

very best seeds, bulbs, shrubs and trees should be used in all this work.

To be a successful, intelligent gardener is not easy; it requires a knowledge of many things, not the least important of which is the study of the soil. Simple lessons on the origin, the physical and chemical properties of soils and their relation to the needs of different plants, can easily be comprehended by the children.

Injurious insects are a serious menace to plants. As millions of dollars' worth of agricultural products are annually destroyed by them, a knowledge of their life histories, of the most vulnerable stage of their development, of their manner of feeding, and of the best means of combating them, is most important. A knowledge of the food habits of nestling and adult birds, and their relation to keeping insects in check is of great economic significance.

A student following the plan indicated, giving to it an hour a week, would leave school at the end of the course with a fund of information and experience immediately available for practical uses, or with a broad foundation for any course in biology he might elect.

The practical side of this movement has been emphasized because that is the test which is dominant in the minds of most people. The interest and delight which are brought into the lives of little children through such an in-

timate association with nature can be realized only by those who have worked with children.

The story of the life histories of birds, insects and plants is an introduction to some of the most marvelous phases of creation, and gives a realizing sense of the wonder and sacredness of life whose influence can not be estimated.

CHAPTER II

SCHOOL GARDENS IN EUROPE

The study of gardening originated many years before Christ, when the great Persian King, Cyrus, laid out gardens in which the sons of noblemen were instructed in horticulture. Very little is known of the progress of this science for more than two thousand years. During the early part of the sixteenth century, botanical gardens were established by the Italian University and in almost every important city in Italy. Educators soon realized their importance, and Comenius declared, "A school garden should be connected with every school where children can have opportunities for leisurely gazing upon trees, flowers, and herbs, and are taught to enjoy them."

About a hundred years later, Rousseau, in his Émile, emphasized the importance of school gardens as a factor in education. Basedow included school gardens among educational agencies. Campe with his wards planted ten thousand trees. Salzmann wrote, "School gardens have been laid out, neither to draw the attention of passers-by, nor to give great returns, but to

instruct." Pestalozzi taught his wards in field and garden and said, "I wish to make my estate the central point of my agricultural and educational efforts. The orphans are to be kept and to be instructed at work and through work." Froebel advanced the school-garden idea and established gardens in the larger German cities of his time.

There was little permanence in the spasmodic efforts of individuals, but when the Austrian Imperial School Law of March 14, 1869, decreed that, "Where practicable, a garden and a place for agricultural experiments shall be established at every rural school," there was a new impetus given to the movement, and it is now conceded that the agricultural and horticultural progress of Europe is largely due to the efficiency of the school gardens.

The Agricultural Society of Switzerland encourages and gives financial support to the establishment of such gardens. Since the reorganization and improvement of the school systems of France, a law of March 18, 1882, "outlines a course of study for primary schools that places the first instruction in horticulture and agriculture in the school gardens in the middle grades, where pupils acquire a knowledge of soil, fertilization and field work." In the higher grades they learn farming, agricul-

ture, bookkeeping and horticulture. The instruction not only includes theory, but practise work in the garden. Another important decree of December 11, 1887, declares that "No plan of a school-building in the country to which the State contributes shall be accepted unless a garden be attached."

In Belgium horticulture is compulsory. All public elementary schools have gardens, which must contain at least thirty-nine and one-half square rods, and the teacher must be qualified to give theoretical and practical instruction in vegetable culture.

The garden movement is not regulated by law in England. The theoretical and practical work is generally under the direction of the agricultural schools. Sweden was one of the pioneers in an interest in school gardens. They are required by law, and there are about five thousand. In Norway and Sweden the manual training has become so important in the systems of education that gardening is somewhat on the decline. Owing to the severity of the climate the school gardens of Russia are confined to the southern part of the country. They include the raising of grain, vegetables, fruit, kitchen-truck, grapes, mulberry-leaves for supporting silkworms, fruit-trees, and the cultivation of bees.

SCHOOL GARDENS IN EUROPE

In Germany the school-garden movement is not regulated by law, but is encouraged, and some of the most successful gardens may be found within her borders. Austria-Hungary alone has eighteen thousand school gardens, of which the province of Styria has eight hundred —not a school without a garden.

When the importance of school gardens as a factor in the training of children is considered, and their efficiency has been so thoroughly demonstrated by European countries, it seems almost incredible that their establishment in the United States should have been so long delayed. They are nowhere among us regulated by law and with very few exceptions are not incorporated in the regular school work. However, the influence on the moral, intellectual and physical natures of children is so apparent that it is safe to predict that during the next few years a school without a garden of some kind will be an exception.

CHAPTER III

SCHOOL GARDENS IN AMERICA

CHILDREN'S gardens, instead of school gardens, would better express the existing order of things. Various enterprises have been undertaken under different auspices in different parts of the country. Boston was the pioneer, and has done some of the best work—supported by the Massachusetts Horticultural Society, the Massachusetts Civic League, the Women's Auxiliary of the American Park and Outdoor Art Association, the Twentieth Century Club and the Normal School.

The largest and most complete garden in this country was established and is supported by the National Cash Register Company of Dayton, Ohio. One of the most technical gardens, where the children have experience in grafting, budding and greenhouse work, is at the School of Horticulture, Hartford, Conn. The garden at the Hyannis Normal School has a vital connection with home interests, and with business training through the practical experience it gives in buying, selling, drawing checks, and

the like. The school garden of Teachers College and the roof garden of the Speyer School are phases of the great educational system of Columbia University. The Department of Agriculture at Washington has given encouragement and training to teachers and students of the Normal School of that city, supplying them

An Experiment Garden, Washington, D. C.

with instructors and equipment for their work. A portion of the Department Grounds has been devoted to a children's garden. Another very important phase of this work is being carried on in Washington by those interested in improving the condition of the poor. These gardens, about five hundred in number, are in all parts of the city at the homes of the children. There are twelve experiment gardens, under

the direction of trained men who give the children the instruction necessary for good, intelligent work. The Home Gardening Association of Cleveland has done similar work with most gratifying returns.

Newspapers have encouraged this movement by offering prizes for good work, and St. Louis is an excellent example of what can be accomplished by encouragement and appreciation, the results being evident in all parts of the city. Village Improvement Associations have demonstrated the importance of this work in many places from Massachusetts to Missouri. Very efficient work has been done at the Indian and Colored Schools of Hampton and Tuskegee. Gardening, or agricultural education, is one of the solutions of the race problems.

The " Children's School-Farm " of New York City illustrates what can be done by the individual effort with the aid of philanthropic persons and public officials to render assistance in support of an object that has been demonstrated to be of great moral value. Excellent results have been accomplished in Rochester under the support and encouragement of the Women's Educational and Industrial Union. In Minnesota, Wisconsin, Illinois, Iowa, Missouri and other Western States, where there is plenty of ground, the school-garden movement is being

extended and excellent results have already been secured. Interest in this movement is growing and has the approval of all who are interested in educational and sociological progress.

Schools in Canada are beginning to study gardening on broad scientific lines. Men have been sent by the Department of Education to some of the best colleges and universities of the United States to be thoroughly trained for this most important work. Large areas of land have been devoted to this purpose. The school laws of the West Indies also include extensive plans for school gardens.

Boston has been a pioneer in the school-garden movement, and has succeeded effectively along many lines. The work was instituted twenty-five years ago by some philanthropic persons of Boston who petitioned the Horticultural Society to assume the responsibility of organizing a committee whose duty should be to try, if possible, to mitigate the hard and dreary life conditions of poor people, by introducing some "sweetness and light." The committee was supplied with all the money necessary for carrying on the work, and permitted to use the seal of the society on its circulars, thus beginning with good financial, scientific and moral backing. The committee undertook at once the English custom of window-garden-

ing, and secured the cooperation of city missionaries, teachers of mission and other schools, and officers of associated charities. The custom of distributing cut flowers at Easter-tide was quite general in the churches, and, through the influence of this committee, the Sunday-school

Paving Removed for a Garden, Boston, Mass.

superintendents were induced to purchase and distribute potted plants, which were more lasting in their beauty. The results were very gratifying, and, in 1879, there were three exhibitions held in Horticultural Hall in Boston. The great hall, devoted to the display of the best plants, was an interesting sight, as the

children brought their plants in bloom and out of bloom, all eagerly expecting the prize. Gradually, lack of interest and funds caused the decline and final abandonment of the enterprise.

In 1887, a reorganization was made on a different basis, the Horticultural Society assuming the financial support. The School-Board granted special permission to the teachers to interest and instruct children in plant-growing, and the exhibition at Roxbury, largely the work of boys, gave evidence of the efficient work done by them. Prizes were awarded for cut flowers raised by the children, and for collections of wild flowers, arranged in vases, and correctly named.

The committee decided to offer prizes for window-gardens, to be ready for exhibition during the month of March. The experiment demonstrated that plants will grow under the most unfavorable conditions. A member of the Horticultural Society who was a lover of children, provided plants suitable for winter blooming, placed a room of his greenhouse at the disposal of the committee, and insured care of the plants. Seeds and cuttings were obtained and five hundred plants were given to the children. In 1887, one school furnished growing plants, and on Easter Sunday, 1890, thirteen thousand plants were distributed.

The work has grown steadily and is being carried on under different auspices. The Twentieth Century Club of Boston assumed the expense—ninety-two dollars—of establishing a school garden containing eighty-two beds in the yard of the English High School on Dartmouth Street. Boys from the Rice School and girls from the Franklin School enjoyed its privileges. The students of the Normal School also received instruction in the theory and practise of raising flowers and vegetables.

The Massachusetts Civic League of Boston inaugurated a playground on a large tract of land on Columbus Avenue. This is equipped not only with apparatus for the exercise and the amusement of children under the direction of trained instructors, but contains inside the fence three hundred and fifty children's gardens, each three and a half by six feet, in which a variety of flowers and vegetables affords the little gardeners great pleasure and profit.

The George Putnam School Garden, Boston, is one of the oldest and best known in the country. The wild-flower garden was begun in 1890 and has supplied the school with nature-study material. The kitchen-garden was inaugurated in 1900 with eighty-four beds, each three and a half by ten feet, and progressed on lines similar to other gardens. In the autumn the ground

was prepared for receiving bulbs. The German method of tillage—fall plowing for keeping the soil light and open to admit air and moisture, thus setting free plant-food and supplying nitrogen—was explained. After the soil was properly prepared, bulbs were put in for spring blooming.

The nature-study work of the Junior Naturalist Clubs is carried on under the auspices of the Extension Department of Cornell University, and it is an effort to introduce agriculture into the schools, in a mild form. The clubs have been organized about four years, and have been increasing in number and strength and usefulness each year. There are about three thousand in New York State and several hundred outside the State.

To supplement the nature study of the classroom, gardens were planted on school grounds—three or four of the principal cities of the State being selected for purposes of experiment. Most successful and encouraging work was accomplished at Rochester. Arrangements were made with one of the leading seedsmen of the State for sale of seed packets at a cent a packet, and the work had the stimulus of competition. Children were encouraged to purchase seeds for home gardening and the progress of the undertaking has been most gratifying.

Two phases of the work are strongly emphasized—the ethical and practical. An effort is made to inculcate a love of natural objects, trees, flowers, insects, birds, and to demonstrate the best methods of successful gardening.

No organization has accomplished more effective and permanent results than the Home Gardening Association of Cleveland, Ohio. Its policy has been business-like, and nothing has been attempted that has not been successful.

The improved conditions of many homes are due to its influence. A new feature has been undertaken this year—the establishment of four vegetable gardens, three in the school yards, and one in a vacant lot near a school—by the association and the School Council in cooperation.

The following extracts from the report of the Home Gardening Association of Cleveland for 1903 indicate the progress of the work:

"One call of the present time is 'back to nature.' It is a cheery invitation. Multitudes go from the city every year to enjoy for a time the delights of the country. Other larger multitudes must stay behind in cramped quarters where there is plenty of smoke and dust, but little to suggest the beauty of the fields and woods. The Home Gardening Association has pointed out a way to make the city wilderness bloom, to cause flowers

to blossom in the smallest spaces. This has been done in order that those who can not go to nature may have a touch of it near at hand. The process has been educational. The president of the association was convinced at the start that if people only knew what to grow, and an easy way could be found to provide the seeds, the desired

Window-Boxes at Goodrich House, Cleveland, Ohio.

result would come. The development of the work and the proportions to which it has grown are shown by this fourth annual report.

" Window-boxes presented to Goodrich House by the Home Gardening Association were undisturbed all summer. The boxes were within easy reach of the sidewalk, toward which the vines

hung down in tempting array. Men, women and children went to and fro every day and yet scarcely a leaf was touched. A few years ago the experience would have been different. Flowers planted in beds, along the same sidewalks, at that time were picked as soon as they appeared or the plants plucked up, roots and all. This year the flowers bloomed without molestation. The

Test Garden in the Center of Cleveland, Ohio.

change is due to an awakened love for flowers. A considerable proportion of the people in all parts of the city now have gardens of some sort at home. Those who care for flowers—plant the seed, watch the young shoots, await the opening of bud into blossom—respect the living plant everywhere, and enjoy the touch of natural color which it brings. The Home Gardening Associ-

ation from the beginning of its existence has shown the possibility of flower culture and has called attention to the pleasure such occupation brings. The influence of the association is indicated even more clearly by the incident of the window-boxes than by the increase in the quantity of seed distributed.

"*Seed Distribution.*—The kind of work done by the association in former years has been continued without essential change, although some new features have been added. The distribution of seeds, 153,705 packages, was larger than ever before. Of these packages, 132,095 went to the pupils in Cleveland Public Schools, 5,700 packages to other local organizations,* and 15,910 to

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*"One of the local organizations, the Slavic Alliance, which used the seeds, sent through its president the following communication:

"'The Slavic Alliance was organized in Cleveland in December, 1902. Its field of activity and service is among the people of Slavic origin. The Slavic race is represented in our city by members of the following nationalities, here given in the order of their numerical strength, namely: Bohemians, Poles, Slovaks, Slovenes, Croatians and Russians. By birth or descent there live to-day in Cleveland about 100,000 persons of Slavic blood. The Slavic Alliance is a non-sectarian organization, its object being purely educational and philanthropic. As stated in its constitution, its purposes are: "To foster a spirit of kinship among the people of Slavic origin for the purpose of uplifting the race; to aid them in all that tends to their moral, social and intellectual advancement; to assist them in the defense of their common interests, and to teach them the rights and duties of American citizenship."

organizations and institutions in different parts of the country. This means that the seeds went to 25,000 Cleveland homes at least. The money received from the seed sales paid the expenses of the association, including the money paid for flower-show prizes, for lectures, for the Rockwell School yard, for the exhibition garden, for the Goodrich House window-boxes, and for the excess in cost of bulbs ordered from Holland. The method of seed distribution adopted last year proved so satisfactory that no change was deemed necessary this season. The envelopes, on each of which one order could be made (by marking the number of packages desired opposite the varieties), to which the name and address of the person giving the order could be subscribed, were again used.

. " 'The work of the Home Gardening Association of Cleveland was called to the attention of the members of the executive body of the Alliance, which consists of delegates from the various lodges or societies of the different nationalities. The beneficial results of this work, both material and moral, appealed to all, and it was decided to begin our part in the crusade for a more beautiful and healthful Cleveland, and to arouse in our people a greater civic pride. And so we incorporated as a permanent feature the home-gardening movement in our working program.

" 'The work of the Slavic Alliance is from the nature of things supplementary to that of the Home Gardening Association. As large numbers of the Slavic children attend the public schools, they are therefore reached directly by your association. However, the Alliance seeks to arouse a general interest in home gardening everywhere, among old and young

"The lectures given in the public schools accomplished the purpose for which they were given. Twenty-four schools made arrangements to have them. The lectures were illustrated with lantern slides. Hand-bills passed about in the neighborhood of the school usually secured an audience sufficient to fill the meeting-place. The lecturer endeavored on every occasion to bring out the way in which seeds should be planted and cared for, but emphasized also the possible arrangement of plants to exhibit to best advantage their size and color. The growing qualities of the various seeds were also mentioned. The illustrations included not only artistic arrangements of form and color secured in famous gardens by skilled workmen, but also results obtained by those who planted the seeds distributed by the

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alike, and its first success gives encouragement and much promise for the future. The Alliance sold about 6,500 packages of flower-seeds. The Slavic newspapers of Cleveland, and even some in other cities, heartily indorsed the home-gardening movement and encouraged it. Many orders for seeds were received from points outside of Cleveland.

"'For the year 1904 the Slavic Alliance is making preparations to give a greater impulse to this movement. Among other things 25,000 copies will be issued in four different languages of a pamphlet upon home gardening and home improvement, containing instructions and hints as to successful cultivation, and dealing separately with each variety of flowers in this year's list. The Alliance seeks to meet the situation in the most practical way, and hopes to realize in some humble measure the fruits of these efforts for the good of our fair city and for the enrichment of its civic life.'"

association the previous year. To these were added pictures of the flower-shows in the schools. Interest centered in the pictures of these flower-shows. The desirability of making a flower-show in each school was mentioned. 'The aim of the talks was to indicate the possibilities of natural beauty in the city where the children have little contact with birds and trees and other natural objects.'

"*The Dellenbaugh Prizes.*—In May, Judge Dellenbaugh offered bulbs as prizes for the best gardens, one reason for the offer being that: 'The completion of our Park System and the adornment of our yards with shrubs and flowers will make Cleveland old mother earth's matchless beauty spot.'

"The florists and seedsmen of the city now give every encouragement to the association, and well they may, for within the past year or two their sales have about doubled."

The leaflets shown on pages 31 to 33 with others have been issued by the Home Gardening Association.

The Boys' Garden established and maintained by the National Cash Register Company of Dayton, Ohio, was the first garden in the United States instituted and owned by a corporation. Its president, a thoroughly practical and successful business man, attributes his suc-

The Home Gardening Association.
1904.

DIRECTIONS FOR CARE OF THE GARDEN.

Plant seeds in garden or boxes early in May.
Fill boxes with four or five inches of fine, rich soil.
Place boxes in sunny place, and sprinkle every day.
Cover boxes at night, if very cold.
Transplant seedlings to the garden about June 1st, on a damp day.
Sow seeds of Calliopsis, Nasturtiums, Morning-Glories and Four-o'clocks in the garden, as they do not stand transplanting.

SUGGESTIONS FOR WINDOW-BOXES.

Make the box six or eight inches deep, twelve to fifteen inches wide, and as long as the window is wide.
Fill the boxes with fine, rich soil and fasten firmly to the sunniest window.
Place similar boxes on the porch or fence.
Plant Morning-Glories on the side nearest the house and train up on strings.
Plant Climbing Nasturtiums near outside, to hang down over the box.
Plant Calliopsis, Zinnias, Marigolds, Asters or Verbenas in middle of box.
Plants should stand four or five inches apart.
Boxes need water every day.

MAKING OF YOUR FLOWER-BEDS.

Select sunniest part of the yard.
Avoid a place where the dripping from the roof will fall on the bed.
Best effects are produced by planting all of one variety in one place.

PREPARATION OF THE SOIL.

Dig up the bed as early as possible, a foot deep.
Mix with the soil some rich earth, well rotted manure, or leaf-mold from the woods.
Rake the beds and keep the soil fine and free from lumps.

PLANTING OF SEEDS.

See directions on the Seed Packet.

WATERING OF THE GARDEN.

Sprinkle the beds every day, if necessary, until the plants are one inch high.
Do not allow the soil to become dry.
Sprinkle thoroughly every few days, when the plants are two or three inches high, instead of lightly every day.
Water in the morning and evening.

THINNING OF PLANTS IN THE GARDEN.

Avoid having plants too crowded.
Thin the plants when they are two or three inches high, on a cloudy day, when the soil is moist.
Transplant seedlings pulled up to another bed, or give them to some friend.
Take up a little soil with each plant.
Use a trowel, an old kitchen-fork or small, flat, thin stick.

PICKING OF FLOWERS.

Do not allow flowers to go to seed.
Pick them every day and more will bloom.
Allow a few of the best flowers to go to seed for next year's garden.
Keep beautiful, fresh flowers in your house and share them with the sick.

THINGS TO REMEMBER.

Dig deep and make the soil fine on the surface.
Keep pulling out the weeds all summer.
Sprinkle the seeds every day.
Water the bed thoroughly every few days during the whole summer.
Pick your flowers every day.
Keep your garden neat.
Flowers require attention all summer.
By attending to these things you will have flowers all summer and for the flower-show in the fall.

Home Gardening Association

PRIZES FOR 1904

FLOWER-SHOW PRIZES:

First Prize — $10, for the best show in each group.

Second Prize — $5, for the second best show in each group.

(The schools will be divided into four groups, according to size and location.)

In awarding prizes the judges will give special attention to flowers grown from Home Gardening seeds.

Judge Dellenbaugh will present 1,000 bulbs for out-door planting to every school which has a creditable flower-show.

These prizes will be awarded with the understanding that the money and bulbs are to be used to improve school grounds.

GARDEN PRIZES:

First Prize — $10, to the school where the percentage of pupils enrolled who cultivate gardens is largest.

Second Prize — $5, to the school where the percentage of pupils enrolled who cultivate gardens is next largest.

The teachers will arrange sometime during September to have a descriptive letter written by each pupil who has a garden. The number of these letters will be reported to Miss Emma Davis, Rose Building, before Nov. 1st, 1904.

The prizes will be awarded on the basis of the number of these letters. In this contest a window-box will count as a garden. The money received from these prizes is also to be used in the improvement of school yards.

Judge Dellenbaugh will offer prizes for the best gardens and window-boxes in each ward. The conditions of this contest will be published in the daily papers on Saturday, May 14.

The Home Gardening Association congratulates the pupils of the public schools upon the large number of gardens planted last year. These gardens added very much to the beauty of the city. It is the hope of the association that every pupil may have a well-cared-for garden or window-box this year. In this way Cleveland would become the most beautiful city in the country.

The Home Gardening Association.

SEEDS FOR 1904.

Price One Cent a Packet.

Mark opposite the variety the number of packets wanted.

Separate Colors Cannot be Ordered.

Aster, mixed, Scarlet, White, Blue & Rose, 15 inches high		**Nasturtium,** a climber, Yellow, Orange and Red, 6 ft. high	
Bachelor's Button or Cornflower, Blue, Pink and White, 2 ft. high.		**Nasturtium,** bush, Yellow, Orange and Red, 1 ft. high.	
Balsam or Lady Slipper, Mixed Colors, 2 ft. high.		**China Pinks,** mixed, Pink, Scarlet, White and Lilac, 6 inches high.	
Calliopsis or Coreopsis, Yellow and Brown, 2 ft. high.		**Phlox,** mixed, Scarlet, Pink and White, 1 ft. high	
***Cosmos—Mixed,** White, Pink and Red, 5 ft. high.		**Scarlet Runner,** A climber, Scarlet, 7 ft. high.	
Four-O'clock, Yellow, White and Crimson, 2 ft. high.		**Verbena,** mixed, White, Scarlet, Purple, 6 inches high.	
Marigold, Yellow, 1 ft. high.		**Zinnia,** Scarlet, 2 ft. high.	
Morning Glory, a climber, Mixed Colors, 12 ft. high.		****Gladioli Bulbs,** Red, Yellow and Pink, ONE CENT EACH	

Return this envelope to the teacher, with your money. Do not put money in this envelope.

No. of packets..... Amount .....cents.

Write your name here.....

Address.....

Grade..... School.....

Your seeds will be delivered to you in THIS ENVELOPE about May 1st. Prepare your garden in April. Select the sunniest part of your yard, but avoid a place where the dripping from the roof will fall on the bed. Dig deep—a full foot. Soil with well-rotted manure dug in, will give better results than poor soil.

Four-O'Clock, Bachelor's Button, Marigold, Calliopsis, Zinnia, Morning Glory and Nasturtium are the easiest to grow successfully.

*Cosmos is not recommended for smokiest districts. Blooms in October.

**Gladioli Bulbs should be planted right side up, in a good, rich soil, in a sunny situation, six inches deep and six inches apart. Will send up one stalk of bloom three months after planting. Flower stalk may need support by tying to a stick. The bulbs should be taken up in October and planted next spring. Store where they will not be frozen. Will make a fine display in school yard.

Many Window Boxes should be planted. TRY ONE.

Facsimile of Ordering Envelope.

Workers in the Boys' Garden, National Cash Register, Dayton, Ohio.

Boys' Garden, National Cash Register, Dayton, Ohio.

cess in life to the industrious habits contracted when he was a boy on a farm. He agrees with all thinking people who consider the present educational system seriously, that there is too much involution and not enough evolution; too much poured in and not enough drawn out; too much training of the head and too little of the hand and the heart. In order to counteract this and stimulate thought and activity he determined to establish a Boys' Garden. In 1897 a piece of ground adjoining the factory was laid out in plots, ten by one hundred and thirty feet. Forty boys, ranging in age from eight to sixteen years, were enrolled under the direction of an experienced gardener, and began work. The number of these gardens has grown until now there are seventy-one, each ten by one hundred and seventy feet. A convenient tool-house was built and water-pipes run in at convenient points about the garden. Each boy has a separate hoe, rake and spade, the number of which corresponds to the number of his garden, and he is responsible for keeping his tools clean, in order, and in their proper places. The head gardener instructs the boys in the care of tools and in the planting of vegetables, appointing a different boy each day as his assistant, whose duty it is to inspect the garden. The head gardener also cultivates a plot of his own, in com-

petition with the boys, the real object being to demonstrate the proper way of planting without too much instruction.

Simple lessons in the study of soils, in the proper method of planting and of tillage are given in a practical way that appeals to the intelligent interest of a boy, and he is taught to do by doing. The boys sow beets with onions, raise two crops of lettuce, three or four of radishes, thus utilizing the soil at all seasons. Peppers were planted with onions, beans and peas; eggplants and cabbages, and cantaloups with the cabbage. Tomatoes and potatoes were raised. Turnips grew with the potatoes. Beans were planted with the watermelons and harvested before the melons were grown.

Each boy is entitled to the product of his labor, and so abundant has been the harvest in some instances, that one boy provided his entire family of five with vegetables during the entire season and cleared five dollars in money. He won the first prize and a position in the factory, where he made himself so useful that at the end of the first week his salary was advanced fifty cents. When asked by the foreman where he formed his habits of industry he promptly replied, "In my years in the garden." The testimony of a man thoroughly acquainted with the work is that the children develop thirty per

Children's School-Farm, DeWitt Clinton Park, New York, September 13, 1902.

Children's School-Farm, DeWitt Clinton Park, New York, October 18, 1902.

cent more rapidly in moral, mental and physical power than if they were confined strictly to their school work.

During the season of 1902 the first "Children's School-Farm" in New York City occupied a space one hundred and fourteen feet by eighty-four feet on an unimproved area on Fifty-third Street between Eleventh and Twelfth avenues, which is destined to become a part of the park system of Greater New York. Although overlooking the Hudson River it was an unpromising situation for a garden, having been for years a dumping-ground and a storage-place for trucks. It was necessary to import good loam and as the season for planting was late—July 27th—quick-growing seeds were selected. Each "farmer" had a plot, three by six feet, for which he was responsible and to the products of which he was entitled.

Twenty-five children worked at a time, under careful supervision and direction. The gardeners detailed by the Park Department were Swedes who had had experience in School Gardens in their own country and who realized the benefits of such training.

The children were drawn from the densely populated West Side, those who came first being enrolled without distinction of age or sex. They worked with interest, intelligence and enjoy-

ment, and by their energy and constancy of purpose, clearly demonstrated that a "bad boy" is only a case of misdirected energy. The second year of the experiment many new features were introduced which broadened the scope of the work and gave it a greater sociological significance. A small house was erected and equipped, and two girls were appointed each day to serve as housekeepers. They were taught the simple duties of housekeeping, sweeping, dusting, scrubbing and ironing and the responsibilities of a hostess. The house was provided with window-boxes and the yard carefully sodded and adorned with flower-beds. A pig, a rooster, several hens and some small chickens afforded additional interest.

This experiment has demonstrated conclusively that the vandalism incident to the congested condition of city life, will cease when a legitimate outlet for self-activity is afforded.

Excellent work has been accomplished by the members of the Junior Horticultural School of the Civic Improvement League of St. Louis. The League has been active and instrumental in beautifying that city, and finding employment and amusement for boys during vacation. When the plan of teaching them farming and gardening was conceived, the Trustees of the Shaw Garden offered five acres of land for the

purpose. Each boy was given a plot, eleven by one hundred and sixty-five feet, which he planted after a model set by the young woman in charge, who is a trained gardener and botanist. Her own model farm was alongside the others, and when a boy needed some individual information and stimulus, he was sent to the model farm for observation, and he then endeavored to perfect his own.

When the crops were matured, some of the boys took their products home or sold them to their neighbors, while others had regular customers who called and purchased directly from the "Farms." A business man gave money for prizes and announced that he would give money for the gardens next year, and also for one in North St. Louis. On accepting the offer the chairman of the committee said that he expected to have a thousand juvenile gardens next year.

The Superintendent of Schools of Halifax, Nova Scotia, reports that the children are induced to make gardens at their homes which they can cultivate during the summer vacation. A money grant from the city of Halifax insures the establishment and maintenance of children's home gardens in that city. A recent report says: "To study the subject of agriculture to any extent in the public schools seems to require a

specialist and more time than is now allotted to it. Such a specialist, employed by five or six schools and required to give the whole, or part, of one day each week to each school, would seem to me to meet the need, and supply what in some counties of the province has come to be an urgent demand."

School Garden, San Piadro, Porto Rico.

The school-garden movement has reached Jamaica, Porto Rico and other islands of the West Indies, and reports from the West Indian Bulletin show how important and essential this phase of practical work is considered in the educational development of the islands. Its study includes air, soil, seeds, weeds, grasses,

shoots and roots and experimental work in plant physiology.

"In one of the most successful schools—Mount Fletcher, St. Andrew—I am informed that small children beg for seeds and cuttings to take home, and they not only cultivate flowers but raise considerable quantities of vegetables which are either consumed locally or sent to the Kingston market."

The Barbadoes Agricultural News of January 3, 1903, says: "School gardens are rapidly becoming recognized factors of educational work in several of the colonies. The time is approaching when every child in the West Indies will be able to learn the principles underlying agriculture."

The Kamehameha Girls' School in Honolulu furnishes a practical education to Hawaiian girls from fourteen years of age and over, qualifying them for service at home, for wage-earning in some handicraft, or for entrance to the Normal School to be trained for teachers in the Government Schools. The School is well endowed by its benefactor, Bernice Pauahi Bishop, who died twenty years ago, and who was of royal blood in direct line from the famous Kamehamehas. In the industrial department of the School, the pupils have high-grade instruction in weaving, lace-making, sewing,

Kamehameha School, Honolulu, Hawaiian Islands.

dressmaking and cooking. As a part of their five years' course in Nature Study, the girls make and care for a school garden. The garden-plot, forty by twenty-four feet, is divided into small beds for vegetables, fruits and flowers, each girl having a patch of her own for which she is responsible. As this outdoor work may be done all the year with no intermission for snow and ice, the girls can always exhibit well-kept beds of Carnations, Marigolds, Asters, Lilies, and some Hawaiian varieties of flowers. The Hawaiians as a race are lovers of flowers and music, and it is natural therefore that these girls should have more interest in flowers than in vegetables. One of their great pleasures is to braid or string the blossoms into *leis* (necklaces) for favorite teachers or departing friends.

During the past year the vegetable garden has yielded corn, cucumbers, and lettuce, enough to supply in their time the different school dining-tables. A short time each day is spent by every girl in her garden-plot, and on Saturday morning all the girls don their native hats and work for an hour in the school garden.

CHAPTER IV

IMPROVEMENT OF SCHOOL GROUNDS

THE editor * of a well-known magazine recently asked five hundred business men all over the country "whether in their opinion there is any financial value in attractive surroundings to a business plant." Ninety-five per cent of those replying declared that the product of a factory or a business concern is much more valuable when the factory or office is clean, attractive and beautiful, and when the employees come in daily contact with orderly surroundings and see grounds made attractive by plants and flowers. Furthermore they declared that such well-ordered business concerns are commercially a decided benefit to the community.

A question of equal significance might be asked of educators, preachers and parents, whether in their opinion there is any moral, intellectual or spiritual value in attractive school surroundings; whether children are happier or their work is made more efficient by daily con-

* Mr. Louis E. Van Norman, editor of Home and Flowers, November, 1902.

tact with beautiful school grounds; whether a cultivated taste and appreciation of the beautiful would not find expression in improvement

Individual Planting, Public School 153, Bronx, New York City.

of home conditions and in that way make the school a radiating center for civic improvement.

The great interest in public beauty which is manifest all over the country is largely due to the efforts of The American Park and Outdoor Art Association and the American League for Civic Improvement. These societies have done much valuable service in the way of organization and education. There is no better place

to begin than in the public schools, the most effective means of reaching the parents being through the children.

Work is being undertaken by Civic Clubs and Women's Clubs in cities and by Improvement Associations in towns and villages. The time has come for action; the movement is on. In large cities property is considered too valuable to be utilized for school grounds and gardens, but as soon as citizens and municipal

Planting in Masses, Barnard College, New York City.

authorities are aroused to an appreciation of the importance of this movement better conditions will prevail. Some landscape architects are interested and excellent results have been

accomplished. As was suggested in a recent number of Park and Cemetery, school grounds might be opened to the citizens as breathing spots during the long summer vacations and warm summer evenings, thus forming a stronger bond of sympathy and interest between school and parents.

The greatest need as well as the greatest opportunity is in village and rural districts. And alas! too often there is only bleakness and barrenness. School directors seem to set apart the poorest ground in the district for the school yard; there are no flowers, and only some weak grass and a few starved trees. Will nothing grow? By a little effort these unattractive surroundings could be made pleasant and beautiful. Children should be led to study Nature's method, and to examine her manner of planting flowers beside the road, grouping trees and shrubs along the fences, in the woods and upon the banks of the streams. The wind, the birds and squirrels, Nature's agents, have no regularity in their seed-planting. Consequently the irregular massing of her trees, shrubs and flowers, and their struggle for existence produce pleasing variety and effective results all the year round.

Some of the trees, plants and vines found in field and wood can be so arranged as to

form attractive groups. Trees can easily be obtained, and the most desirable are Elm, Ash, Beech, Birch, Maple, Poplar, Pines and

Amelanchier botryapium: Shadbush.

Spruces; and these shrubs are surely common enough—Sumach, Elder, Dogwood, Barberry, Witch-Hazel, Laurel, Rhododendron, the Ferns,

Goldenrod, Aster, Daisy, Milkweed, Sunflower, and the attractive Bittersweet, Clematis, Wild Cucumber, and Virginia Creeper. Pictures of good landscape-gardening will suggest what can be accomplished in a school yard.

Two women in a New England town became interested in the improvement of school grounds. They called at the High School, and invited all the students who were willing to assist in beautifying their school grounds to attend an illustrated lecture on Landscape and School Gardening, to be given at a private house for their benefit. The women were delighted to have every member of the school respond. After the pictures were shown, the students brought out the plans which they had been asked to bring, and suggestions were made as to the most artistic grouping of trees and shrubs. The next morning the school was organized and committees appointed for specific parts of the work —a general committee, one to secure the trees, another the shrubs, and another the vines. Native trees and shrubs were generally used, as they were easily accessible in the woods near at hand. The students were deeply interested and the work was soon well under way.

An attempt was made to improve the rather dreary school grounds of a certain village. Committees were appointed from the Village

Improvement Association to visit the schools and endeavor to enlist the support and cooperation of teachers and pupils. The children responded and worked well, but the results showed that neither teachers nor children were educated up to an appreciation of the eternal fitness of things. In this case familiarity had

Rosa setigera: Climbing Rose.

produced contempt, for instead of being alive to their opportunities and taking advantage of material collected from woods and fields they destroyed or disregarded the "wild things" and planted seeds that came in paper packages.

One school was surrounded by a field of the most fascinating moss-grown and lichen-covered glacial boulders. The teacher said she

could not do much, as her place was "full of rocks." In meadows close by were masses of *Berberis vulgaris,* several varieties of Cornels, Wild Roses, Black Alder and fences covered with Bittersweet, Virginia Creeper, and Wild Clematis, which could have been transplanted, producing artistic results. Instead of doing this the children laboriously carried some of the smaller boulders, made a pile of them, covering it with earth in which they planted Nasturtiums, Marigolds and Balsams. The effort was praiseworthy but the results might have been more artistic and permanent.

In still another school the teacher was most enthusiastic and anxious to improve her school grounds, which were attractively located, surrounded by the beautiful, undulating hills so characteristic of glaciated New England. The back yard was "burned over" to destroy the weeds—Sweet Fern, Sumach, Asters and Goldenrod, and a clump of White Birches was cut down. Oh, the unsightly trunks of the once graceful trees! The misguided teacher did not appreciate her blessings. In one corner a "rockery" had been made, on which a few weak Nasturtium cotyledons struggled toward the light.

This school was revisited in the autumn. The roadside for several miles approaching it

formed a succession of brilliant pictures. The gorgeous colors of the Sumach with its deep-red velvety fruit, the ringing tones of the Golden-rod, the more subdued notes of the Asters, the vine-covered stone fences—all were glorified by the autumn haze. A bend in the road suddenly brought the school yard into view. The contrast! Once it had been part of a harmonious whole, but it had been "tidied up" in the spring ready to be improved, and only a few limp Nasturtiums were left to tell the tale of the zealous but unintelligent effort.

In contrast to this is one teacher who for twenty-two years has had charge of a school with most unattractive surroundings. Under the direction of the teacher, within two weeks after the school had been visited, nineteen trees had been transplanted, a fern garden made, shrubs and wild flowers planted and a screen built. The children were industrious, and are making plans for next year's work. The school took the prize for the best exhibit. Success in this work can be secured only by an educative process.

Conditions similar to those described exist the length and breadth of the land.

To think, to talk, to write will not suffice. Who is to put the spade into the ground?

CHAPTER V

BOYS' GARDEN

This garden was undertaken under the auspices of the Village Improvement Association. When it was suggested there was not an available foot of land, not an available dollar, the only thing that existed being an idea, which was not received with any degree of enthusiasm by the skeptical villagers. To demonstrate the possibilities of such a movement, one of the members volunteered to give a free stereopticon lecture on the subject, of which another member assumed the expense. It was a practical illustration of what had been accomplished by such work, and made some converts. The Association secured permission from the Board of Education to visit the schools and present the subject to the children. Ten boys volunteered to take gardens.

This village of two thousand inhabitants is fortunate in having the Lawrence Playground, a tract of seventeen acres of land, given to it as a memorial. It is delightfully situated, with space for a baseball field, football gridiron and tennis and basket-ball courts. The Commission-

ers of this playground generously offered the use of as much of this land as was needed for the garden, and twenty-five dollars were contributed for tools. The Village Improvement Association had the ground plowed and harrowed. Seed and manure were donated and the use of a small barn for storing tools was given

Good Gardeners, Boys' Garden, Groton, Mass.

by a farmer who was in sympathy with the undertaking. The teachers volunteered their services, and when the garden was a living proposition and spoke for itself, fifteen dollars were given for prizes. When the work began, the plot was an unpromising piece of ground, full of weeds, witch-grass, and plowed-up glacial boulders; but the boys went to work with

a will and soon brought order out of chaos. Each boy was provided with a hoe, rake, spading-fork and trowel. The watering-cans and wheelbarrow were for general use.

The individual gardens were ten by ninety feet—a space which taxed the energies of most boys and was too much for some, who fell by the wayside. But the interest was growing and their places were easily filled. The plan was carefully drawn to a scale and followed exactly. Flowers, squashes, lettuce, radishes, red beets, turnips, tomatoes, beans, peas, potatoes and corn flourished. Some of the boys raised all of the vegetables needed by their parents and sold some besides.

The boys came twice a week after school, Monday and Thursday, and worked two hours, and two days a week during the summer. It was often difficult to have them leave the garden because they were interested. The raising of vegetables was not the primary interest in the minds of the instructors; it was to give the boys some idea of the great interrelations in Nature, and have them appreciate the forces at work overcoming the hard, resisting rock, changing it into soil; the soil into root, stem, leaves, flowers and fruit; the plant into blood, muscle, bone, nerve and vital energy; the disintegration of the organic and its return into the inorganic.

All the work was based upon sound psychological and pedagogical principles. They learned to do by doing; proceeded from the known to the unknown. Their curiosity was satisfied when their interest was at white heat, nothing ever being forced upon them. They were instructed when the time was opportune and a desire for knowledge had been awakened.

Taking out the witch-grass demonstrated conclusively its mode of propagation, showing how every particle must be removed in order to prevent its spreading. The removal of the glacial boulders was a physical task by no means easy, and before it was completed the general impression was that rocks grew. This gave an opportunity to examine them and to study the difference in texture and composition of the granite rocks, which had been deposited so abundantly in the glacial drift of New England and of most of the territory west and north of the Ohio and Missouri Rivers. It was very easy to relate the disintegration of these rocks to the sand, gravel and clay of the soil, and to point out the influence of the great Ice Age upon the agricultural and industrial progress of the region which was glaciated.

On one occasion, being storm-bound in the tool-house, the boys, reluctant to go home, begged the teacher for a talk. The odor from

a bag of commercial fertilizer, being rather obtrusive, suggested the subject—plant-food. The boys realized that they require a varied diet to sustain the different parts of their bodies, as lime for the bones, etc., and were shown that the same thing is true of plants. Nitrogenous food develops a strong, vigorous system of leaves and stems, while potash and phosphoric acid intensify the colors of flowers and produce plump, well-developed, rich seeds. Commercial fertilizers are easily digested by plants. It is necessary for barnyard manure to go through a decomposing process before it can be reduced to a soluble form available for plants. The different kinds of vegetables growing in the garden were discussed, and it was decided which would need nitrogen, as lettuce, and which would require phosphoric acid, as corn, beans, etc. Roots of the clover, beans, and peas were examined for tubercles, and the wonderful story of the nitrifying bacteria told to the boys. They could understand the facts, but the reasons—they are beyond scientific men. The relation of the conservation of moisture to tillage, capillarity in the soil, earth mulch, gave to the soil a new significance.

While the potatoes were being cut up for planting, their storehouses of plant-food and their uses were discussed. Radishes, beets,

carrots and turnips assimilate their food and store the product in the thickened root, to be utilized for sending up the flower-stalk and maturing seed. It is stored in stems and leaves of celery and cabbage and in the thickened underground stems of the potato. The annuals, as corn, beans, peas, direct their energies the first year to the maturing of seed. As soon as the seeds are matured and the little spark of life is protected and surrounded by assimilated food which will be available when conditions shall make it necessary, the life and energy pass on, the stem and leaves have done their work, they disintegrate, the elements are unlocked and return to the earth and air which gave them.

The boys soon found that there were other things to contend with besides weeds and witch-grass. There seemed to be an insect for every green thing that appeared above the ground. One day one of the boys came with a squash-bug. The sucking mouth-parts were examined, and another boy was sent for a potato-beetle, to illustrate insects with biting mouth-parts. Opportunity was afforded to distinguish between them, and directions were given for combating them. During the summer the boys learned to recognize over fifty insects and to distinguish between the harmful and the bene-

ficial varieties, the best means for combating them, and also learned the life histories of many. Some took pride in learning the scientific names. One of the first remarks in the garden this year was, "There is *Clisiocampa americana* on your dress."

They learned thirty different birds by color, song, flight, food habits, and economic relations in keeping insects in check. (A song-sparrow nested this year in a clump of grasses near the garden where the children were passing constantly.)

One day, one of the gardeners presented himself with a large squash-blossom in each hand, and wanted to know what was the matter with his squash-vine, as so few of the blossoms had squashes on them. All of the gardeners were called from their work to hear the lesson on cross-pollination. The squash-blossom was taken to illustrate insect-pollinated flowers, and was compared with the corn, which is wind-pollinated. They learned also the lesson that all form, texture and arrangement of leaves is for the purpose of securing and assimilating food for the perfection of the individual, and that the beautiful colors and markings and marvelous forms of flowers are for the purpose of attracting insects, thus procuring cross-pollination which results in strong,

vigorous seeds and in the transmission of strength and vigor necessary to the perpetuation of the species.

The successful work done by the boys was appreciated, and to reward and encourage their efforts special prizes were offered by the committee in charge, for an exhibit at the Fair in the autumn. The array of cabbages, cucumbers, corn, potatoes, tomatoes, radishes, beets —proved that the garden was not a myth, but a legitimate outlet for the often misdirected energies of boys. A contribution that attracted most attention from the farmers was a case that contained fifty-three mounted insects, which had been found in the garden during the summer, and which were labeled "harmful," or "beneficial."

The boys were invited to a beautiful flower-garden in the village for the purpose of being taught to make cuttings from different plants and were shown how to root them in sand, pot them, and care for them during the winter.

A flower-show was held in the autumn, which sustained the interest. In March it was announced that any child who wanted a Chrysanthemum plant could have one by coming to the boys' club-rooms on a certain day and bringing a flower-pot. Three hundred newly rooted cuttings of choice varieties donated for the pur-

pose were distributed. Instructions in repotting, feeding, training and disbudding taught the children how to care for them and have them in good condition for a Chrysanthemum show, in November. Boys' and Girls' Clubs were organized in the autumn for some work in Arts and Crafts. At the May Party there was an exhibition and sale of the work done by the children during the winter, and part of the proceeds were devoted to defraying the expenses of the gardens the following summer, forty of them, each ten by sixty feet—thirty for boys and ten for girls.

CHAPTER VI

PLAN OF A GARDEN

For purposes of convenience, it is desirable to have the garden adjoining the school, in order to secure the greatest good to the greatest number. The typical school-yard soil is not conducive to luxuriant vegetable growth and will probably have to be replaced by some good light sandy loam, as sandy or clay soils require careful treatment. The soil may be all that is desired, but if there is no water-supply the plant-food is not available. The success of the garden will depend largely upon the convenience and the abundance of the water-supply.

The size of the garden depends upon local conditions—the number of sections and the number of children. Each child should have an individual plot in the vegetable garden. A space ten by thirty-five feet affords a child plenty of occupation and enables him to have a rich reward for his labors. Such an allotment would be impossible in a city district—three by six is usually the average there.

To be of the highest educative value, the

work must be progressive. An active, ambitious, intelligent boy would tire of raising radishes year after year, if there were nothing in it but raising radishes. But if he is led to realize the relation of the roots to the soil; the arrangement of the leaves for catching the sunlight and shedding the rain; the assimilation of nutrition and the storing of the food in the root; the using of the food store in the root for the production of the blossom and the maturing of the seed; the effect of the perfect work done by the plant upon the next generation of plants; the results of blight and insects upon the plants and the transmission of weakness and disease—if the raising of a radish means that to a boy, he has learned lessons of vital importance—lessons that will influence him all his life.

It may be necessary to define the limits of the garden. If it is for protection, a close wire fence covered with vines will serve the purpose and enhance the beauty of the garden. A hedge always lends a charm and there are so many quick-growing desirable shrubs that a hedge is easily secured.

The plan of the garden requires the greatest consideration. Generally the space is so small that to go into landscape-garden effects is impossible, and the best results are secured by

adhering to a more formal and symmetrical treatment.

From the practical standpoint, what would meet the demands of a rural school would be useless in a city. It is necessary to study local conditions in order to secure the best practical results. As for the educative side, the life history of the plants may be as effectually learned from the study of a burdock or a dandelion as from the study of a tree.

The plan here submitted may be used in its entirety if the space permit, or be suggestive as a plan, which may be adapted to various conditions.

The planting of trees and making of lawns are most important. Hedges for screens and for the defining of boundaries are coming more into favor and should be encouraged.

There are great possibilities in a shrub border. A judicious selection of shrubs may serve as a screen to obliterate unsightly objects and harmonize the whole plantation. A succession of blooming from early spring until late autumn is possible, as are also charming effects in texture of foliage from the delicate gray greens of the early spring through the rich greens of the summer to the gorgeous autumnal tones of scarlet, orange, reds, bronzes and purples. The tones of the foliage are enlivened or subdued

by the richness of the scarlet, white, blue or deep purple of the fruit. The color scheme may be continued through the winter by a judicious

A Home Garden in May, Washington, D. C.

grouping of the shrubs, whose winter stems are brilliant in bright red, yellow, vivid green, purple and rich brown; the whole border will then seem enveloped in a haze of composite color of twigs, with here and there a dominant note, that accentuates and gives character to the composition.

A school garden to accomplish its purpose must be broad in its influence. All plans, op-

erations and instructions must take into consideration the home of every child; he should in the garden find something which he can cul-

The Same Garden in August.

tivate in a small way at his own home; it may be a flower-garden on a fire-escape, a strawberry vine in a tin can. He will have received an impetus and a love for "green things growing."

An herbaceous border is easily made and gives opportunities for children to revel in color. Perennials are most satisfactory, for they take care of themselves and increase rap-

idly. This fact especially commends itself to village and rural schools.

In small city and town lots, where herbaceous and shrub borders are not possible, some suggestions for a small formal garden are important. This requires great consideration, care and good taste in the selection and arrangement of plants and the securing of artistic color effects. This style of gardening appeals very strongly to some persons and is capable of producing satisfying results.

Most children are very ignorant of the wealth and beauty of our native flora. A garden of wild flowers arranged according to systematic classification gives much important information; inculcates an appreciation of the rare and fast disappearing species and engenders a feeling of protection and stewardship.

The vegetable garden is most practical. It develops responsibility of ownership and respect for the rights of others. It also encourages children to become producers.

For general information, the experimental beds containing food, fibrous, medicinal and common poisonous plants grown under different conditions of soil, present some problems on the economic side of gardening.

Budding, grafting, pruning and other practical lessons given in the nursery make students

skilful in caring for their own trees and shrubs, and open a way to remunerative occupations. The work is all wholesome and conducive to making better, stronger boys and girls and more industrious, law-abiding citizens.

CHAPTER VII

HEDGES

Deciduous shrubs, as a rule, make more satisfactory hedges than evergreens, because they can better endure the unnatural conditions to which hedge plants are subjected. It is important to use hardy, carefully selected plants in making a hedge, as it is almost impossible to repair an old hedge by setting in new plants.

Hemlock, Norway and White Spruce, and Arborvitæ make excellent hedges, and prove quite hardy where the winters are rigorous. A tall, slender evergreen hedge is best formed of American Arborvitæ, and a dense, bushy hedge of Norway Spruce. The Hemlock makes the most beautiful and graceful hedge, and is especially adapted to dry and stony ground—conditions which are most often met with in school grounds.

Box is most desirable for low borders of walks, but is expensive. *Ligustrum ovalifolium*, California Privet, is most highly prized of all ornamental hedge plants. It has been considered so desirable for use in hedges, be-

cause of its fine growth and almost evergreen habit. It is not entirely hardy in New England, and many hedges are destroyed by severe frost.

Berberis thunbergii — Purple-Leaved Barberry—is one of the most attractive and popular hedge plants, but it has been used so generally in parks that it has lost the charm of novelty. It has, however, many good qualities to recommend it to consideration. The plants grow extremely thick right from the ground, and require very little pruning to keep them in shape. The branches are pendulous, covered with clusters of small, light-green leaves, which in the autumn assume a brilliant scarlet. Its beauty in the spring is enhanced by clusters of yellow blossoms, giving place to masses of bright scarlet berries, which remain nearly all winter.

Hibiscus syriacus — Rose-of-Sharon — lends itself to hedge-making. It has the merit of blooming in August and September, a season when few other shrubs are in flower. It is remarkably free from fungous diseases and the attacks of insects.

Cydonia japonica—Japan Quince—is especially desirable on account of its good habits and handsome foliage. In the early spring the hedge is aflame, and in summer the reddish tinge of the new leaves affords an unusually

fine display of color. The bronze tones of the coloring continue the charm in the autumn. Aphids attack the tips of the young shoots, but

Cydonia japonica: Japan Quince. Hedge partly trimmed.

these are removed when the hedge is trimmed in the summer.

Buckthorn, Hawthorn, Honey-Locust, Hornbeam, and Osage Orange are extensively used for defensive hedges.

The preparation of the soil in which a hedge is to be set consists in thoroughly plowing, cultivating, and enriching an area six feet wide and the length of the proposed hedge. The plants, properly trimmed, root and top, are set in a single row, nine inches apart, in a trench

or furrow through the center, wide enough to admit the roots without bending. Growth is facilitated by having a quantity of good top-soil carefully firmed about the roots of the plants, and well-rotted stable manure worked in with the soil in the trench.

Evergreens should be pruned in spring, just before they commence growing. In clipping hedges of Hemlock, Spruce, and Arborvitæ into formal shape they should be cut with sides sloping to an apex, so as to be wider at the bottom than at the top. Thus the lower branches get more light and air than they would if the sides were perpendicular, and they would not be so likely to lose their leaves and die.

Pruning of deciduous hedges is most easily done in July, when the shoots are young and tender. A flat-topped hedge, although very good form, is liable to injury from a weight of snow; consequently, a Gothic arch or triangular outline is more desirable.

A hedge always lends dignity and privacy to a garden. It may serve many purposes—as an attractive approach to a building; as a protection to the lawn; as a screen for unsightly objects; and as a good background for foliage masses, bright flowers, brilliant fruits and stems of shrub borders.

CHAPTER VIII

PLANTING NEAR A BUILDING

Generally dwarf evergreen trees or shrubs produce most pleasing effects near the base of a building. Greens harmonize with any color of stone, brick or paint. Box, Arborvitæ, Yews, and any of the numerous horticultural varieties of evergreens are desirable.

When conditions of soil and climate are right, nothing exceeds Rhododendrons and Kalmias for massive evergreen effects. The leaves are so rich and beautiful, and the flowers so abundant and effective, that a better selection could not be made. They thrive naturally in woods where the soil is rich in organic matter, almost entirely leaf-mold, the roots growing very near the surface. Ordinary garden soil, especially that containing lime, would be fatal. The ground must be carefully prepared and the surface heavily mulched with leaf-mold.

In front of the Kalmias and Rhododendrons mass *Andromeda* (*Pieris*) *floribunda*. It is excellent for irregular borders and for screening plants that are apt to become "leggy." The

foliage is evergreen and in the early spring the plants are covered with a mass of white, bell-like flowers. Mahonia, or *Berberis aquifolium,* is good throughout the year. The masses of bright-yellow flowers among the new, glossy growth of leaves are most attractive in the early spring; the foliage is a rich green all sum-

Andromeda (Pieris) floribunda: Andromeda.

mer, and the autumnal and winter coloring of rich, dull red, greens and bronzes is unexcelled.

The exquisitely beautiful and fragrant *Daphne cneorum* is one of the most attractive flowering shrubs; it is of dwarf habit, from one to two feet high, and evergreen. In the spring a border of it is a mass of delicate rose-pink flowers of delicious perfume.

A colony of dwarf evergreens, or one of Rhododendron, Kalmia, Andromeda, Mahonia, Daphne, would be permanent and satisfactory.

California Privet, *Ligustrum ovalifolium*, trimmed to a foot or a foot and a half makes

Daphne cneorum: Daphne.

an excellent hedge for bordering walks and protecting lawns. A Hemlock hedge is possibly the best background for a shrub border, but as it is of slow growth, another may be substituted, as a tall Privet hedge or Arborvitæ. Althea makes an excellent screen and could be used with good effect to separate the garden and playground.

For the sides of the garden a wire or board fence, a covering of quick-growing vines, as *Ampelopsis quinquefolia, Ampelopsis veitchii,*

English Ivy, Morning-Glories, Cypress-Vine, Wild Clematis, Wild Cucumber, *Rosa wichuraiana*, *Rosa setigera*, white, crimson or yellow Rambler, supplied with rich soil, will produce a beautiful effect.

The Pergola, an arbor planned to separate the arboretum from the vegetable garden, can be made an attractive feature of the plantation. It need not be expensive, but may be made out of

An Arbor.

unhewn trunks of trees for uprights, and smaller trees for crossbeams, and in the spring may be a mass of pendant white and lilac Wistaria. Later the June roses come; in August the Trumpet

flower; in September, the *Clematis paniculata;* and during the winter the orange and red berries of the Bittersweet. The planting may be done so as to afford shade throughout the summer and a succession of blooming from early spring to late autumn.

Material for shrub borders is so abundant and so satisfactory that the temptation to select a great variety of shrubs and thus destroy the unity and harmony of the whole is very strong. Effective shrubs are the Viburnums, Cornels, Spiræas, with Forsythia for a touch of gold in the early spring; a *Weigela rosea* for a flush of pink for the later spring; and *Hydrangea paniculata grandiflora* for late summer and autumn blooming. Some of the best Cornels are *Cornus paniculata, Cornus stolonifera, Cornus amomum, Cornus florida.* They bloom at different times and have different colored stems and fruit.

Viburnum opulus, Viburnum opulus sterilis —common Snowball—*Viburnum tomentosum,* and *Viburnum tomentosum plicatum*—Japanese Snowball—*Viburnum lentago,* and *Viburnum dilatatum* are beautiful in flower and fruit. Of the Spiræas, select *Spiræa vanhouttei* for masses of flowers; *Spiræa thunbergii* for early blooming and lightness of foliage; *Spiræa prunifolia* for wreaths of white blossoms and especially for the color and texture of its foliage. *Ber-*

beris thunbergii has drooping habits of growth and is valuable as a border and a screen for the ground. It assumes the most brilliant and most gorgeous autumnal coloring, which is succeeded by the brilliancy of the abundant red berries, which remain on the shrub all winter.

CHAPTER IX

THE FORMAL GARDEN

The making of the lawn, the planting of trees and shrubs, the setting of hedges are more for decorative than for educative purposes. Through planning and executing a formal garden the children will realize the possibilities and limitations of a small plot of ground. The training and incentive received from such an experience will tend to manifest themselves in the improvement of their own home grounds, and thus a pleasant relation will be established between the school and the home.

The plan should aim to secure a succession of blooming; harmonious effects in texture of foliage and color of flowers; a balance of parts; repose and dignity of the whole. A plot of ground fifty feet square is sufficient space in which to do some interesting work and to secure some good effects.

The accompanying plan suggests a possible garden. A border of sod one foot wide, extending all around the plot, defines the garden. Two five-foot gravel paths divide the garden into

four equal squares, admitting of easy access into the interior of the garden. When the planting begins, set in the sod hundreds of Crocus corms, which will respond to the first warm breath

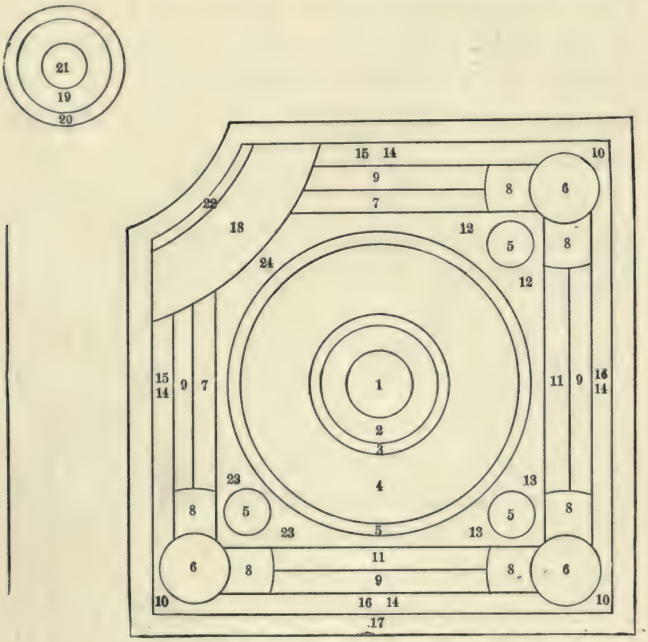


Diagram of the Formal Garden.

1. Yucca filamentosa
2. Gladioli
3. Asters
4. Poppies
5. Asters
6. German and Japanese Iris
7. Foxgloves
8. Phlox
9. Anemone japonica
10. Larkspurs
11. Canterbury Bells
12. Columbine
13. Snapdragons
14. Heliotrope
15. Jonquils, Narcissi, and Pansies
16. Hyacinths and Pansies
17. Sod and Crocuses
18. Tulips and Peonies
19. Calendula and Mignonette
20. Yellow Pansies
21. Sun-Dial
22. Yellow Pansies
23. White Lupins
24. Larkspurs.

of the early spring, making the garden a place of cheer and delight.

In the center of the garden a circle five feet in diameter is reserved for the sun-dial. Around its base plant Calendula, which will be a mass of brilliant orange in the late summer and autumn, and masses of Mignonette. Border this bed with yellow Pansies. Repeat the yellow Pansy border on the inner edge of the large, central, circular bed. This bed, which is three feet wide, devote to pink, white, yellow, and dark-red Tulips, to be succeeded by white, pink, and dark-red Peonies. When the bed is once properly made it need not be disturbed for a long time, and will increase in beauty. The foliage of the Peonies is clean, vigorous, attractive, free from disease and insects, and will produce a restful area of green in the center of the garden in pleasing contrast with the succession of color during the summer.

Plant a good specimen of *Yucca filamentosa* —Spanish Bayonet—in the center of each small area. It is stiff and formal in its growth, in keeping with the plan. In three of the corners put German Iris for May and June, and Japanese Iris for July. The colors are so exquisitely beautiful now, and even after blooming, the spear-like leaves of the plant produce effective contrasts in texture of foliage with other

plants. Near the Iris plant a clump of Lilies, some of the best being *Lilium auratum, Lilium candidum, Lilium speciosum rubrum* and *album,* and *Lilium longiflorum.* These will bloom all summer. On either side of the Iris plant a clump of Phlox, pink and white, avoiding the dull reds which produce a discordant note in the garden. They grow from two to four feet, and will bloom from July until frost if the heads are cut off after blooming.

Inside of the grass border prepare a bed a foot wide, in which set bulbs of Narcissi, Daffodils, and Hyacinths.

Border the main paths through the garden with Daffodils which bloom in April, and Narcissi which bloom in May. The Hyacinths can be put around the outside of the garden. This bed, bordered with Pansies of all colors, will produce a profusion of blossoms, which the children can pick freely, as the beauty of the bed will deteriorate as soon as the seeds begin to mature.

When the bulbous plants have passed their prime, and the weather is warm enough, fill the bed with Heliotrope. The color is good, the perfume delicious, and the blooming continuous until autumn. It is a good plant from which to make cuttings; it roots easily, and the children can propagate it for their own gardens.

One of the most successful and satisfactory bloomers is the *Anemone japonica alba.* It is hardy in the Northern States and blooms from September until frost. It requires rich soil to bring it to its highest perfection, and is easily propagated by root-cuttings, even the strong fibrous roots producing plants which will probably bloom the following year.

New and good things constantly introduced into the garden, and means of propagation taught, will enable the children to become familiar with the most desirable plants and their methods of culture and perpetuation. When the beds are rearranged in the autumn, and masses of plants separated for replanting, there will be hundreds of plants to be given away, which the children will receive with intelligent interest and sufficient knowledge to care for them properly.

Clumps of *Digitalis* — Foxgloves — planted near the Peonies will send up their tall and graceful spikes during June and July, and make an attractive, effective accent for the center of the garden. Plant Canterbury Bells in the opposite sides. Within this area mass White Lupins, *Delphinium*—Larkspur—*Antirrhinum*—Snapdragon—and *Aquilegia*—Columbine.

Shirley Poppies and Carnation Poppies will

produce a wilderness of bloom all summer. New varieties of *Gladioli* corms, planted at different times, will produce a succession of blooming.

Many of the perennials and biennials lose their beauty early in the season, and it is well to prepare for the autumn blooming.

Dahlias come in such fine variety of form and color and are so decorative that clumps planted between the Phlox and Lilies will add character to the garden, when other plants no longer charm.

The blossoms of the Asters are desirable in the autumn; and during late September and early October the attraction of the garden will be enhanced by a profusion of choice pink and white varieties. Seedlings can be planted in every vacant spot in the spring, and as the flowers pass the plants can be cut down, giving the Asters space for development.

The suggestions for this garden include tones of green, yellow, white, lavender, and pink, with a dash of darker color in the Dahlias. Other combinations of red, orange, and blue will suggest themselves, and be expressive of individual taste.

CHAPTER X

HERBACEOUS BORDER

Some school grounds are so limited and the conditions such that it is not possible to attempt anything more than an herbaceous border. Nothing, however, would afford greater returns for the labor than the annuals, biennials, and perennials which are now to be secured in such beautiful forms and such varied and satisfactory colors. The proper place for such a border is against a fence, or planted to screen outbuildings, ash-heaps, or anything that is unsightly. The best effect is produced against a background of green. Either cover the fence or building with some quick-growing vine, as *Ampelopsis quinquefolia*—Virginia Creeper—English Ivy, *Clematis paniculata,* or plant shrubs of rapid growth and good luxuriant foliage, as Syringa, Lilac, Buckthorn, *Spiræa prunifolia*—Bridal Wreath—or any of the many desirable shrubs that are suggested for the nursery.

The space to be occupied should be thoroughly cultivated and heavily enriched before planting in order to produce the most perfect

types of plants and most profuse blooming. Wood-ashes added to the soil will accentuate and intensify the colors of the flowers.

There is a difference of opinion and taste as to the arrangement of plants in a border and the form of the border. One three to five feet

Clematis paniculata: Clematis. Suggestion for a Piazza.

wide produces best effects when the edge is straight and the plants in rows. A wider border loses its stiffness when the edge is varied by irregular, undulating curves.

A successful planting results in harmony of color and profusion of bloom from May until November.

The plan requires careful consideration.

Select and dispose of perennials first, as their place in the border is permanent and they need not be disturbed. Biennials will have to be renewed every two years, and annuals every spring.

The color scheme is all-important. Children are more unconsciously sensitive to color than is realized, and although the combination of color may be brilliant and stimulating, it must not be discordant. Many color schemes will suggest themselves. It is possible to have delicate pink, lavender, blue, and white in the spring, giving place to brilliant and gorgeous effects of scarlet, yellow, orange, and purple in the autumn.

The tallest plants reserve for the background — Goldenrod, Asters, *Boltonia,* False Chamomile, *Rudbeckia,* Golden Glow, and white Cosmos for autumn blooming. In front of these plant a row of Dahlias—deep, rich colors of the single, large, and double pompon and cactus varieties. Then plant a row of double pink, and white, and single yellow Hollyhocks. In front of this a row of Foxgloves and Canterbury Bells. Among the Hollyhocks plant seedling Salvias, and among the Foxgloves and Canterbury Bells white Asters. Border the bed with Shirley and California Poppies, white Lupins, and Mignonette. Cut the Hollyhocks

down as soon as they cease blooming, and give the Salvias space and opportunity for late summer and autumn blooming. The Foxgloves and Canterbury Bells will give place to the Asters. The white Lupins bloom before the Poppies are ready, and the California Poppies and Mignonette are good until frost.

Long rows of plants are very good, but are apt to become monotonous unless broken up. A large clump of pink and white Peonies would be a charming relief for one place, and a mass of white Phlox and light and dark perennial Larkspurs in another. A mass of *Ricinus,* or Castor-Oil Plant, with dark purplish-red foliage, grouped with *Salpiglossis*—brilliant, crimson, scarlet, netted with golden yellow—would give a decided note in the border. Another effective group is a clump of Cannas with large massive foliage of rich bronze purple, and a mass of *Tritoma,* the "Red-Hot Poker" plant.

There is so much excellent material and the plants multiply so rapidly that if good judgment is used in the selection of plants and seeds, the border may be enlarged from year to year, or the plants separated and distributed among the children.

Perennials give by far the greatest satisfaction, for when they are once in the ground, and

given plenty of food, they need very little further care. They also have the merit of very early blooming.

Seeds of biennials must be planted every year, as the plants die after the second year. Annuals are very profuse, but not early bloomers.

The profusely illustrated catalogues annually published by the most reliable floral companies are full of interesting and practical information.

LIST OF PLANTS DESIRABLE FOR AN HERBACEOUS BORDER

Antirrhinum—Snapdragon. Half-hardy perennial; showy spikes of pure yellow, bright scarlet, garnet, rose-pink, and snow-white; two to three feet.

Aquilegia—Columbine. Hardy perennial, thriving in moist soil; unique, graceful flowers in white, rich blue, yellow, delicate azure; foliage exceedingly good; one and a half to three feet; May.

Asters. Annuals for autumn, prolific, and continuous blooming; "Purity," glistening pure white, and "Daybreak," shell-pink; one to two feet.

Calendula. Dwarf, bushy annual, blooming abundantly until frost; "Orange King" and "Lemon King" are excellent varieties.

Coreopsis. Hardy garden plant; large, rich, orange-yellow flowers during summer; two to three feet.

Calliopsis. "King," dwarf, yellow, golden, and crimson with garnet eye; two feet.

Candytuft. "Empress," white, good for borders and edgings; dwarf annual; blooms all season; twelve inches.

Delphinium—Larkspur. Magnificent hardy garden plant; six to ten feet; color ranging from pure white, delicate lavender to deep indigo and purple; bloom continued for several months by cutting spikes immediately after blooming.

Digitalis—Foxglove. Hardy perennial; long spikes of large, showy flowers, ranging through purple, white, rose, and spotted; three to five feet.

Gaillardia. Showy garden annual; rich and varied colors; one to two feet; June until frost.

Eschscholtzia—California Poppy. Annual, producing flowers of beautiful form and texture; brilliant, shining yellow and orange; one foot; June until frost.

Hollyhock. Hardy biennial; robust in growth; excellent effects in many situations; five to eight feet; massive spikes of white, cream, pink, yellow, and deep-red flowers; July and August.

Marigolds. Gorgeous masses of brilliant yel-

low and orange during summer and autumn; dwarf variety good for edges of border.

Lupins. Annual and perennial; white, hardy perennial; a great acquisition to the garden; bush four feet; leaves very decorative.

Mignonette. Great favorite; healthy, rich, green foliage, and the subdued tones of the flowers produce a restful note in the garden; perfume delicious; one foot.

Nasturtiums. Dwarf varieties of compact growth make a good bedding plant, the leaves in their exposure to the sunlight making a perfect mosaic of green.

Nicotiana. Annual; flowers sweet-scented, pure white, rose, rich crimson; foliage large, luxuriant, and tropical in effect; two to three feet.

Penstemon. Beautiful garden annual; pink, white, scarlet, and purple flowers; two to three feet.

Pansies. Varied in color and form; exceedingly attractive in early spring, with their delicate and deep rich colors and velvety texture.

Hardy Phlox. A great favorite for herbaceous borders. The colors range from vermilion to pink, blush, and salmon shades. They are sturdy in their growth, profuse in flowering, and remain in bloom during the late summer months; two to three feet.

Poppies. Wonderful variety in coloring; Oriental Poppies produce gorgeous masses in May; Carnation and Shirley are best for summer blooming; seeds may be sowed broadcast in the border, and it will be the "survival of the fittest"; two to three feet.

Salvia. A gorgeous mass of color may be secured from the Salvia. The contrast between the brilliancy of the flowers and the vividness of the foliage is startling; two to four feet; late summer and autumn.

Salpiglossis. Beautiful garden annual; flowers brilliant crimson; scarlet, netted with golden yellow; eighteen inches.

Ricinus—Castor-Oil Plant. Large, luxuriant, rapid-growing annual; subtropical effect; prized for foliage; color of leaves varies from bronze maroon, light red, and dark purplish red to light and dark green; three to ten feet.

Tritoma—"Red-Hot Poker." Hardy perennial; tall spikes of orange-red flowers; August until frost; four to five feet.

Zinnias. Well-known hardy annual; large double flowers in summer and autumn; orange, crimson, pink, yellow, white; two to three feet.

CHAPTER XI

GARDEN OF WILD FLOWERS

By the time the students are ready to enter High School they should have a speaking acquaintance, at least, with one hundred of our native wild flowers and twenty common ferns. It is not advisable nor possible to introduce all varieties into the garden, for conditions are so unnatural they could not live, and many resent being taken from their native haunts. The wise thing is to select species that are tolerant of poor conditions and try to improve them under cultivation.

The selection, to be of educative value, must contain typical specimens of *Monocotyledonous* and *Dicotyledonous* plants. The *Spadicefloræ* may be represented by Skunk-Cabbage, Jack-in-the-Pulpit, Cat-Tail, *Calla palustris; Glumifloræ,* by grasses and sedges; *Petaloidæ,* by Lilies and Orchids. The *Dicotyledonous* plants include *Apetalæ* — Wild Ginger; *Polypetalæ* — Buttercups, Clover, Lupin, Roses, Saxifrage, Wild Carrots, Parsnips, Mullein, Cardinal Flower; *Sympetalæ*—Bluebells, Goldenrod, Asters, and many other beautiful and hardy flowers.

Most lessons relating to adaptation of structure to function can be given with best results by using wild flowers. They are simple and natural in their structure, while some cultivated flowers have become so modified as to obliterate parts. Simple lessons in plant physiology would illumine the work, as also would some experimental work with soil.

The relation of leaves to catching and shedding rainfall; arrangement and form of leaves in reference to light; modification of leaves and stems for purposes of support; movement of leaves as a protection against heat and cold; color, form, texture, and marking of flowers for the attraction of insects for purposes of cross-pollination; the efforts of roots, stems and leaves for the perfection of the individual; the perfection of the individual culminating in the perfection of the species—these lessons and more of vital importance and interest will make the wild garden a source of the greatest pleasure and delight.

CHAPTER XII

THE VEGETABLE GARDEN

Before beginning any planting the ground must be in good condition—thoroughly plowed, harrowed, and, if necessary, richly manured. Barnyard manure for general purposes is best, for it not only contains all the elements of plant-food, but, what is more essential, aids in improving the physical conditions of the soil, making it more porous, capable of receiving more air and water, and of retaining moisture. A good commercial fertilizer may be employed for the immediate use of plants while processes of decomposition, which are necessary for reducing the manures to soluble form, are taking place in the soil. It is not wise to attempt to experiment with fertilizers on individual plots. This work can best be done on plots that are designed for purposes of observation and instruction.

The accompanying plan providing for individual plots ten by thirty-five feet, each of which could be divided into five plots, six by ten, with a foot-path between them, has been used with satisfaction.

The choice of vegetables is a matter of individual taste, and for some reasons it is best to allow children to make their own selections, especially if the plots are small. But when the space is large the best results are undoubtedly secured by having uniform planting. Squashes, lettuce, radishes, red beets, carrots, spinach, peas, beans, tomatoes, potatoes and corn yield satisfactory returns and produce good material for educative purposes. Marigolds and Nasturtiums were selected for bordering the path because of their dwarf habit of growth. Cannas and Castor-Oil Beans make an effective background for the whole. A good border for the front may be made of scarlet, white and sweet-scented Geraniums, or any annual or perennial flowers, provided the color tones are not discordant.

The greatest care is necessary in planting, which must be done in a systematic, orderly manner. A garden-line is a necessity. There is a great moral force in a straight line. Children are apt to plant seed too thick. Definite instructions must be given and plants must be properly thinned out. Weeding is easily done, but watering and conserving moisture are the important things. When rain falls or the earth is sprinkled, the surface of the soil becomes compact and the spaces between particles of soil are so small that soil-moisture rises by capillary

attraction and passes off by evaporation. After a rain, or after sprinkling, when the surface becomes dry, go over it with a rake and break up the surface of the soil, forming a soil-mulch, thus lessening capillarity. The water is drawn

"A garden-line is a necessity." Boys' Garden, Groton, Mass.

near the surface where it is needed by the roots of the plants, but can not escape into the air by evaporation.

Devote a small plot of ground to food-plants, as wheat, rye, oats, buckwheat and peanuts; to fibrous plants, as flax, hemp, cotton; and to medicinal, as Digitalis, Lobelia, Mandrake, Liverwort, Dandelion, etc. These plots serve for observation and experiments with fertilizers.

INDIVIDUAL PLOT OF VEGETABLE GARDEN

1. Flowers	5. Carrots	9. Dwarf Marigolds	13. Potatoes
2. Lettuce	6. Spinach	10. Path	14. Corn
3. Radishes	7. Peas	11. Dwarf Nasturtiums	15. Cannas
4. Red Beets	8. Beans	12. Tomatoes	16. Castor-Oil Beans.

CHAPTER XIII

WINDOW-GARDENING

WINDOW-GARDENING has been successfully carried on in England and is becoming very common in this country, especially in cities where other gardening is impossible. There are two kinds of window-gardening—summer and winter. For the former, window-boxes are made to fit the window-sills on the outside, or on balconies, where they exist. Boxes may be ornate, made of wood, terra-cotta, iron or wire patterns—the latter affording free drainage and allowing the air to get through the soil to the roots, a great advantage to the health of the plants. The box should be the length and breadth of the window-sill, but never exceed six inches in depth.

The best soil for window-boxes is compost of turfy loam—soil formed by rotted sods that have been cut two inches deep from good pasture-land. Add one-fourth rotted stable manure and thoroughly mix. This is a good soil for almost any growing plant. Where a limited quantity of soil is required this can be secured

from a florist. To be satisfactory the plants must be strong and vigorous in their growth and the soil is liable to be exhausted. The plants will be stimulated by an application of any complete fertilizer in dry or liquid form. A one-pound package, sufficient for twenty-five plants of ordinary size for one year, costs twenty cents.

A complete fertilizer is a highly concentrated form of all the ingredients of plant-food essential to the highest development of plants and flowers. It is soluble, readily assimilated and stimulates to a luxuriant, healthy growth and to an abundance of brilliant flowers.

In the spring these boxes or trays are filled with Pansies, Daisies—the small English Daisy—and the varieties of bulbous flowers, such as Tulips, Jonquils, Hyacinths, Daffodils, Snowdrops. After these have given their best display they are removed and the bulbs saved for another season. With new ones added in the fall, they will again answer for the boxes, or perhaps for the yard. For the summer months these boxes are filled with an almost endless variety of summer-blooming plants. There are several very fine varieties of ever-blooming Geraniums, ranging from the purest white to the deepest red. Begonias are also much used, especially *Begonia rubra* and varieties of *Semperflorens*. *Hibiscus sinensis,* a large brilliant red flower, is much

used for balconies, as are also Oleanders, where there is sufficient space. A number of varieties of vines such as English Ivy, Vincas, and Lobelias, are put into these boxes and hang down in graceful effects.

For shady spots Fuchsias do well, and there are many beautiful varieties. *Salvia splendens*

Window-Gardens: the Alfred Corning Clark Neighborhood House, Rivington Street, New York City.

is a fine, tall, showy plant for large spaces. Foliage plants for summer boxes are Crotons, Dracænas, and Palms. In the autumn the summer flowers can be replaced by hardy Chrysanthemums, which have been prepared during the summer months and are now ready to bud and

bloom. There are also good, hardy evergreens, ranging from the lightest green to the darkest golden brown, blue and bronze shades, all of which make the winter box very effective. The winter plants must necessarily be hardy and evergreen. Some of the best varieties are *Buxus sempervirens*—common Box-Tree—Arborvitæ in varieties, Mahonia, and English Ivy.

For indoor window-gardening there is a great number of varieties, both in foliage and flowering plants.

Before arranging inside boxes, the window-sill should be fitted with a galvanized-iron pan the size of the sill and two inches deep. Painted the color of the woodwork it is inconspicuous, protects the window-sills and catches the drainage water. Conditions of growth are so varied that care should be taken in the selection of plants. The colors should always be harmonious and a few colors selected to preserve the feeling of repose. Green is always useful.

A LIST OF PLANTS FOR WINDOW-GARDENS

Asparagus sprengeri, Climbing or Drooping Variety, is especially adapted to window-gardening. It is ornamental, a rich shade of green, and can withstand a dry atmosphere.

Nephrolepis exultata—"Boston Fern"—is one of the most satisfactory plants. The tips

of the leaves resent being touched and must be protected. It endures poor conditions and does not seem to be injured by draft or furnace-heat. It grows well in the house and can be used for outside gardens in the summer.

Ficus elastica—Rubber Plant—thrives under the most adverse conditions and is sure to give satisfaction. It is tropical in effect, will endure the dry air of schoolrooms and stand more hard usage than any other plant.

Dracæna indivisa—Fountain Plant—is unsurpassed in hardiness as a house plant.

Dracæna godseffiana—Gold-Dust Dracæna—has foliage of a strong leathery texture, highly polished, rich dark green in color, with irregular spots of yellow. It is a hardy house plant and rivals the Rubber Plant in this respect.

Dracæna rubra is beautiful in form, color and texture of foliage.

Kentia fosteriana is a large palm of sweeping foliage and is very desirable.

Kentia belmoreana—"Curly Palm"—is one of the best for general purposes.

Cocus weddelliana—Dwarf Cocoanut—is one of the most beautiful and graceful palms in cultivation.

Pteris tremula, Pteris serrulata, Pteris cretica, Pteris cristata, Pteris longifolia, Adiantum formosum, Lomaria cycadifolia, Blechmun brasilien-

sis, and *Blechmun occidentale* are some of the most hardy ferns. Most ferns, especially Maiden-Hair ferns, are too delicate to survive under poor conditions.

Selaginella vogeli, Selaginella brannii and *Selaginella emmeliana* are good in color, form, and habit of growth.

Cyperus alternifolius—Umbrella Plant—is as decorative as a palm and thrives exceedingly well in soil or water. It is hardy and a beautiful house plant for all seasons.

Aspidistra lurida and *Aspidistra variegata* are exceedingly hardy and endure poor conditions.

English Ivy is useful for inside and outside window-gardens. The leaves are of fine form and texture and it has the merit of great hardiness.

Cyclamens are attractive, and if kept in a light, airy place will continue in bloom six or eight weeks.

Lilies-of-the-Valley can be forced into bloom in three weeks. Set pips, twenty-five in a bundle, in a well-drained pot at the same height and distance apart, pack and cover the roots with sand, and protect the buds with sphagnum moss. Keep wet, cover with a glass and put away in a dark place at a temperature of from eighty to ninety degrees. When necessary re-

move the glass and moss and when the flowers appear bring to the light.

Boxes of *Hyacinths, Tulips, Jonquils, Narcissi,* may be prepared for early blooming. Put the bulbs into the soil. When desired in the spring put them in a warm, dark place and give them plenty of moisture. After the leaves develop and the flowers appear, bring to the light.

Freesias are some of the best and most satisfactory plants for winter gardening. By planting the bulbs at different times there will be a succession of bloom all winter. They require good, rich soil, plenty of water and a temperature of sixty degrees.

Oxalis is a plant of easy culture and profuse and uninterrupted blooming. Bermuda "Buttercup Oxalis" is especially good, the flowers being the purest bright yellow, excellent color for the schoolroom. It is a good plant for showing the "sleep of plants."

Heliotropes can be trained at the side of a window and will be a mass of bloom. They require abundant nourishment, an application of liquid hen-manure the color of weak tea once a week, to keep them in good condition and profuse bloom.

Strawberry plants are easily grown, and by using pistillate and staminate flowers the lesson

of cross-pollination can be taught, as well as propagation by runners.

Primroses are among the prettiest and freest blooming plants, and continue in bloom a long time.

Geraniums are always good and come in many attractive varieties. The pink, white and sweet-scented varieties are especially desirable.

Rex begonias in varieties endure shade and are very decorative. *Begonia rubra* and *semperflorens* are good.

Some of the varieties recommended may seem to be expensive, but by consulting a catalogue it will be found that most of the plants suitable for window-gardening are small and inexpensive. It is better economy to buy good plants that will increase in beauty and usefulness than cheap ones which will soon have to be discarded.

CHAPTER XIV

ROOF-GARDENING

Many school-buildings in cities are now provided with roof-playgrounds that afford excellent opportunities for roof-gardening. In New York the new School of Ethical Culture has ample provision for this work. The building of the Educational Alliance and the University Settlement are provided with roof flower-gardens, in boxes and tubs. The Speyer School, a practise school for Teachers College, is using the roof to good advantage. The roof is flat, tiled, and surrounded by a wall and railing. One part, a space about twenty by four feet, is devoted to a garden. Soil was put down on the tiled roof to the depth of a foot and confined by a plank. The space was divided among the four lowest grades, and devoted to flowers and vegetables. No attempt was made to study soil conditions, but the plans for next year's work include a thorough study of the composition of soil best adapted to the growth of different plants. The box gardens on the wall will greatly enhance the attractions of the place, and give the children plenty of

interesting occupation. The unique feature of the place is the pergola or arbor. It is designed to be covered with vines and afford shade. Tubs

Roof-Garden and Pergola, Speyer School, New York City.

filled with earth are placed at the base of the columns, and are planted with flowers, and gourds for training over the pergola. The roof is also provided with a tool-closet, and a glass-house for storing plants. When not in use this house will serve as a home for the pet animals, where they can live in comfort.

The school-garden work will be undertaken on extensive lines by Teachers College, this being made possible by the generosity of a

friend who is interested in the work. A garden has been started this year—part of a complete and comprehensive plan; and the new greenhouse, recently constructed, will afford students and children the practical experience that is so necessary for successful work.

Roof-gardens are practicable, and should be considered a necessary part of the construction of every city school. As the plants are exposed to the sun, use such hardy plants as Geraniums,

Boys' Roof-Playground, Public School 126, Brooklyn. Possibilities for Roof-Gardening.

Coleus, Salvias, Petunias, Alyssum, Snapdragons, Asters, Eschscholtzia, Kenilworth Ivy, Lantana, Lobelia, Calendula, Four-o'clock, Mignonette, Nasturtiums, Pansies, Poppies, Portulaca,

Castor-Oil Plants, and Cannas. Balloon-Vines and Cypress-Vines are delicate, and ornamental gourds please children. Tubs of Cannas, Castor-Oil Beans and Caladiums produce pleasing effects.

A great difficulty to be encountered in school gardens is the ruinous effect of the long vacations. By sympathetic cooperation of school and vacation school this might be overcome. The children would start the garden in the spring, and care for it until July; the work would then be continued by the vacation-school children, who would care for it through the summer and leave it in good condition for the school in autumn.

CHAPTER XV

SOME PROBLEMS IN SCHOOL GARDENING

THERE may be an earnest desire to have a school garden while the condition may be such as to make it impossible. A paved yard with no sun is enough to dampen the ardor of the most enthusiastic. However, should the space permit, a few of the bricks could be removed along the wall and that space cultivated. Plant an *Ampelopsis veitchii*—Boston Ivy—to cling to the building, fence or wall, and if it is too shady for other plants to grow, ferns and begonias will thrive. The space could be divided into small individual beds, three by three or three by six, and planted to please the owner, or devoted to Tulips, Hyacinths, Crocuses, Jonquils, and Daffodils in the early spring, to be succeeded by annual or perennial plants.

Many school yards are covered with gravel and surrounded by board fences. The effect would be much softened and improved, and the playground restricted very little, by having either a shrub or herbaceous border two or three feet wide all around the yard. The ground must be plowed and thoroughly enriched before

anything can be attempted. Some quick-growing vines, such as the Virginia Creeper, Clematis, Hop, or Morning-Glory, trained over the fence would make a good background. Suggestions for a shrub border can be found in the chapter on Planting about a Building, and Shrubs for

California Privet Hedge. Suggestion for School Grounds.

the Arboretum, and for a herbaceous border in the chapters on that subject.

Very often the front yard is sodded and may be separated from the playground by a hedge of California Privet, Rose-of-Sharon, Japan Quince, Arborvitæ, Hemlock, or *Berberis thunbergii.* Too often the yard is cut up by indi-

vidual trees and shrubs. There is no purpose in such planting, no unity of design. The plants would be more effective massed near the building or around the edge of the lawn. The individual specimens are aggressive, and should retire to be lost in the mass, allowing the building, which is the central figure, to be the prominent feature in the composition, the planting being merely an accessory for adornment.

There is really no excuse for the dreary and forlorn school yards seen so often about the rural and village schools. They are usually unkept, with the schoolhouse, wood-shed and two outhouses standing in bold relief, without a screen of any kind. Two days' work would be sufficient to prepare the earth and plant enough trees, shrubs and seeds to transform the dreary place into one of pleasure and delight. Annual and biennial plants have to be renewed, and to prevent this necessity it is better to use perennial herbs and shrubs. When they are once started they take care of themselves. An irregular border inside of a fence, a screen when necessary, planted about the house, trees along the sidewalk and, where shade is desired, in the yard, so change the place as to stimulate the children to greater effort. When there is absolutely no available space, window and roof gardens are the only alternative.

CHAPTER XVI

SCHOOL GARDENS AND GEOGRAPHY

GARDENING of itself is of the greatest value in the education of children, but it does not perform its complete function in the school unless it has some organic connection with the other work. It is nature study and illumines geography. The soil is part of the earth's surface, derived from the rocks—granite, sandstone, limestone, marble, shales and slates, which form the earth's crust. Children very early get the idea of the great interdependencies of animals, vegetables and minerals and soon realize that plants are the connecting link between the mineral and the animal worlds. They should see in the rocks great storehouses of energy which, unlocked by nature's forces—extremes and changes of temperature, water, atmospheric and organic agencies—are all utilized by plants which form the basis of animal life.

The power of different soils to absorb and retain heat and moisture; the relation of plants to these varied conditions; the influence of the sun upon plant growth—all this gives an experi-

ence which will enable children to interpret the reasons for vegetable growth in cold, hot, dry or moist conditions all over the world. The origin of soil, the disintegration of rock and organic matter, the agents at work—water, air, frost, glaciers, low orders of plants, low orders of animals, the chemical and physical action of higher forms of animals and plants upon rocks —all these are subjects closely related to the garden, and are fundamental in the study of geography.

The transpiration of moisture by plants is one of the causes of the rainfall and of the changes of temperature of the atmosphere. The elements of forestry and sylviculture can be taught in connection with the growth of trees in the arboretum. The vegetable garden relates to the great market-garden industry of the South, and of the regions near large cities. Unless the children are made to appreciate the possibility of securing a livelihood from the soil, the poor and the struggling, who most need a changed condition of life, will not seek the country. A stimulus and taste for country life must come from training in the public schools.

Intensive farming may be demonstrated on experimental plots, with different kinds of food-products, as corn, wheat, rye, oats, sugar-cane,

buckwheat, peanuts, grown under different soil conditions, with varied applications of fertilizers, and the relation may be shown to the great agricultural industries which stimulate commerce and manufacture. The culture of fibrous plants —flax, cotton, hemp, and coco-palm—will add interest to the inventive and manufacturing progress of the country. Flax makes an attractive garden plant because of its beautiful flowers. It requires a warm, sunny place and it is easily raised in the schoolroom. Hemp is a strong, roughish plant and thrives best in moist, rich soil. It grows rapidly and makes a good screen. Seeds may be planted where they are to grow, or may be grown in pots and boxes in the house. Coco-fiber is an important article of commerce, but as *Cocos nucifera*—the cocoanut of commerce—is a large palm, *Cocos weddelliana* may be used instead to show the habit of growth. The cotton-plant may be easily raised in the garden or in the schoolroom. It has a beautiful flower of white, changing to pink. Peanuts are easily grown in the house in sandy loam and warm temperature. They have become such an important article of food, and their method of culture is so unique, that it pays well to raise them.

Medicinal plants can be studied in different parts of the garden where they occur, but the

impression produced would be more distinct if they were assigned a special place in the garden. An herb garden would please the girls, and should they be studying domestic science the herbs could be used to advantage.

CHAPTER XVII

NATIVE SHRUBS

The value of shrubs in producing fine landscape-gardening effects appreciated more and more each year. It is not necessary to depend upon imported exotic shrubs, for the choicest varieties are native to this country. Nothing could be more decorative and satisfactory than the beautiful native Viburnums and Cornels, the Elders and wild Roses, and the evergreen Kalmias and Rhododendrons.

Within a short distance of every school in this country there is plenty of material which could be utilized for improving and beautifying the school grounds, and for developing an arboretum. Children should learn the beauty of common things. It seems to require the educated taste of a trained landscape-gardener to appreciate the beautiful groupings and masses of shrubbery in the meadows and along the roadsides. Nature is a good teacher, and suggests many beautiful effects which would transform the dreariness and barrenness of many school yards.

Shrubs may be used in two ways—as single specimens to display the merits of individual plants, or as part of a structure or design in ornamental planting. The specimen shrub is better the exception than the rule, as a lawn cut up by many isolated trees and shrubs loses its repose, and the unity, individuality, and purpose of its design.

Massed shrubbery will serve to define the boundaries of school grounds; screen the road and unsightly surroundings; relieve the foundations of buildings; border walks or drives; and modify the angularity of the corners of the yards.

As to the choice of shrubs,—those native to any locality are sure to be hardy, and will probably improve under cultivation. Viburnums and Cornels are so widely distributed that they are available in nearly all parts of the country. They are apt to be confounded by a casual observer, but a close study discloses characteristics which are unmistakable. The Viburnums have dentate or cut leaves, the corolla is a five-pointed star with five stamens, while the Cornels have simple, entire leaves, with veins following the outline, and the individual flower is a four-pointed star with four stamens. Some of the Viburnums have both sterile and fertile flowers, as *Viburnum opulus* and *Viburnum*

tomentosum, which by selection and propagation have lost their fertile flowers, and given rise to the

Viburnum tomentosum plicatum: Japanese Snowball.

varieties *Viburnum opulus sterilis*—our common Snowball—and *Virburnum tomentosum pli-*

catum—Japanese Snowball. It is not a mistake to plant varieties of Viburnums in great masses, for they furnish a succession and profusion of blooming from early May until July. The fruit is so abundant in the autumn, the range in color is so great, from brilliant scarlet to dark blue and deep purple, and the autumnal coloring so varied in its tones of rich bronze, purple, and red, that they are as ornamental in fruit as in flower.

The merits of the Cornels are many, and their habits varied. *Cornus florida*—Flowering Dogwood—generally blooms before the leaves develop. The small head of yellow-green flowers, encircled by the whorl of four large, pure white bracts, look like drifts of snow that have lingered long in the lap of spring. The true flowers are the least conspicuous of all the Cornels and the only Cornel (except *Cornus canadensis*—Bunchberry—which is an herb) that has the great white involucre which gives the tree its distinctive character. The tree is choice. It grows well in the shade of other trees and the beautiful oval leaves spread out to catch every glimpse of sunlight. The head of flowers is succeeded by a bunch of scarlet fruit which contrasts strangely with the crimson tones of the autumn foliage. The leaves of *Cornus alternifolia*—Alternate-leaved Dogwood—are inclined

to grow in rosettes forming a perfect mosaic of leaves as they extend to the sunlight.

Cornus candidissima, or *Cornus paniculata,* blooms profusely and is exceptionally fine for irregular hedges. The fruit of *Cornus florida*

Cornus florida: Flowering Dogwood.

is scarlet, but the prevailing colors of the fruit of the cornels are white, light blue and blue. These shrubs deserve to be planted for the foliage, flowers and fruit, but they render most valuable service in the remarkable coloring of their twigs in winter.

Cornus alba—Red Stemmed Dogwood—has brilliant blood-red stems in winter. *Cornus stolonifera*—Red-Osier Dogwood—has red stems but less vivid; and there is also a yellow-stemmed variety. The twigs of *Cornus baileyi*—Bailey's Dogwood — and *Cornus asperifolia* — Rough-Leaved Dogwood—are reddish brown; those of *Cornus circinata*—round-leaved dogwood—and *Cornus alternifolia*—Alternate-Leaved Dogwood —are green, and *Cornus amomum* dull purple. The effect of these brilliant stems against a hedge of somber green Hemlock or a mass of snow is really striking. A most artistic shrub in some situations is the common American Elder —*Sambucus canadensis*. It may be used in various combinations. Its profusion of creamy flowers, and later its masses of shining reddish-purple berries, used with wild roses, produce effects that give pleasure in almost any situation.

Sambucus racemosa — Red-berried Elder— blooms very early, and in midsummer is often a mass of great clusters of brilliant scarlet berries.

In May the hills are flushed with the rose-pink flowers of the *Cercis canadensis,* or American Judas-Tree. The flowers are pea-shape. and as soon as they lose some of their brilliancy the exquisite green of the young leaves appears.

The flowers are succeeded by many-seeded pods, characteristic of the *Leguminosæ* or Pea Family, which become bright rose-colored, changing to brown, and in crowded masses hang on the tree until early winter. The mature foliage of thick leathery texture is good throughout the summer and fall. It may be planted to good advantage

Cercis canadensis: Redbud.

with the *Cornus florida,* as the habits of growth are so dissimilar.

The yellow Flowering Currant—*Ribes aureum*—Missouri Currant—has delicate, pale-green leaves, and flowers of spicy odor, succeeded by black fruit.

No garden is complete without some bushes

or hedges of Syringa or Lilac. The buds are interesting in the spring, the foliage is clean, free from insects, and the flowers are massive. They have been great favorites for centuries. Some of the new varieties are exquisitely beautiful.

There are two native Spiræas, which thrive well under cultivation, and will endure almost any conditions—the *Spiræa salicifolia*—Meadow Sweet—and *Spiræa tomentosa*—Steeple-bush. They are widely distributed, and bloom from July to September. Several cultivated species are in such general use, and have so many good qualities, that they may be used to good advantage in any shrub border. *Spiræa thunbergii* is one of the earliest to bloom, coming with the Forsythias. It has small single white flowers in bunches of two to four, along almost leafless stems. The summer foliage is airy, light green in color, very graceful in appearance, and lightens heavy shrubbery masses; the autumnal coloring is a rich purple bronze, scarlet, and orange.

Spiræa prunifolia—Plum-leaved Spiræa—is more erect and rigid in its habit of growth. The pure white double flowers appear very early in the spring, and remain in bloom a long time. The foliage especially commends it. In midsummer it is bright, shiny, clean, and in autumn has wonderfully rich tones of bronze, red, and

orange. It justly deserves to be placed in the front ranks of flowering shrubs.

It is generally conceded that *Spiræa van houttei* is the finest variety. During its flowering season, in May and June, the plant is covered with a mass of large clusters of white flowers, presenting a beautiful appearance. In her admirable book, Our Northern Shrubs, Harriet L. Keeler describes it well. "It possesses a remarkable beauty of form; in bloom it stands like a great white fountain; in autumn its foliage runs through a bewildering maze of rich claret, deep red with purple tones, bright scarlet, and orange fading to yellow."

The Rhododendrons, Kalmias, and Azaleas are superb in their wealth of bloom and the variety and brilliancy of their color. These plants are desirable, not only because of the beauty of their great flowering masses, but because they are hardy, some of them evergreen, and they may be used in borders or near the foundations of houses.

The shrub which deserves the popularity it has gained is the *Hydrangea paniculata grandiflora.* Its growth is vigorous, and in August the large panicles of greenish-white sterile flowerms make it a most conspicuous, showy shrub. The flowers persist until October, and change through white and pale pink to dull red. As a

specimen plant it is effective, and, properly trimmed, makes an excellent hedge and screen. It grows best in rich, porous, and somewhat moist soil, and thrives well in partly shaded positions, but blooms more freely in full sun if it has sufficient moisture. The branches of the previous year should be cut back in fall or spring to from one to three pairs of buds. If slightly pruned the panicles may be numerous, but small. Pruning back almost to the ground produces enormous panicles, which lack gracefulness, and require artificial support.

CHAPTER XVIII

NATIVE TREES

The names of one hundred and forty trees have been suggested for the arboretum—a rather formidable list; but it is not expected nor desired that any one nursery will contain them all. Begin with a few that are accessible as seedlings, found in the woods, meadows, or roadsides, or what is better, collect seeds and watch their germination and development. Some valuable information may thus be gained about the vitality of seeds, the length of time required for germination, and other subjects of absorbing interest.

No one locality is apt to produce all the varieties of trees knowledge of which is desirable, and in order to secure a valuable collection a system of exchange might be instituted between students of different schools. The seeds of the Oaks, Maples, Walnuts, Hickories, Ashes, Chestnuts, Box Elders, Catalpas, Poplars, Locusts, Elms, Sycamores, Beeches, Tulip-Tree, Pines, Firs, Spruces, Hemlocks, and Larches are obtainable in most localities.

The time for collecting seeds varies from April to November, and many trees retain their seeds during the winter. As the seed production of some trees is variable, it is important to collect them whenever the trees produce a good crop. Seeds of the best quality and greatest vitality are secured from trees that grow in the open, where there is an abundance of light and air. The vitality of tree seeds varies from two weeks to nine years. The seeds of the Maples, Elms, Birches, Poplars, and Willows should be planted soon after maturity, as their seeds have the shortest duration of vitality. In early summer hundreds of young seedling Maples may be found. The Hickorynuts, Walnuts, Butternuts, Beechnuts, Acorns, Chestnuts, and Buckeyes survive scarcely a season. The seeds of the Leguminosæ—Locusts, Yellowwood, Kentucky Coffee-Tree, and Redbud—have the longest period of vitality.

Sow seeds in the seed-bed, and as soon as the seedlings are large enough transplant them to the nursery. In two or three years they will be sufficiently developed to be removed to a permanent place. The children can have the pleasure of transplanting and caring for the trees they have watched and studied, and anticipating their future beauty and usefulness.

To secure the most satisfactory results in

planting it is necessary to have a knowledge of the habit of growth, time of blooming, color combinations of the different trees and shrubs, and their winter appearance in order to secure a harmonious, artistic grouping. Before doing any planting the individuality of the different

Cladrastis lutea: Yellowwood.

trees and shrubs must be considered, and those adapted to the different conditions selected. The choice of material to produce good landscape-gardening effects depends upon the size and location of the school grounds and individual taste.

In the selection of trees there is an embarrassment of riches. Elms are very desirable;

they are stately and dignified when standing alone, and produce arched, vaulted avenues in street planting. *Ulmus americana* and *Ulmus campestris*—American and English Elms—are the most popular, although *Ulmus pubescens*—Slippery Elm—is often planted, and is exceedingly attractive in the spring when the trees are massed with light green, winged samaras. *Celtis occidentalis*—Hackberry—is highly recommended as an ornamental tree. Where it attains its highest development it has a fine round-topped head, pendulous branches, and a strikingly characteristic bark. The leaves become golden yellow in the autumn, and persist some time after the other trees have shed their leaves. It endures varied soil conditions, is free from insects, and bears dark berries, which are attractive to birds in winter.

The Maples have many good qualities to commend them. *Acer saccharinum*, or Sugar Maple, is one of the most beautiful of the forest-trees, and for street planting nothing surpasses it. Symmetrical in growth, it produces dense shade, and turns the most brilliant color in the autumn. *Acer rubrum*, or Soft Maple, has finely cut leaves with long, slender petioles, which respond to the wind, disclosing the silvery whiteness of the under surface of the leaves. Its autumn dress is yellow, and contrasts well

with the crimson of the Hard Maples. *Acer rubrum*—Red or Swamp Maple—is well named. It has crimson flowers before the leaves in the

Acer saccharinum: Hard or Sugar Maple.

early April sunlight, scarlet keys in May, long red petioles during the summer, and is unsurpassed in the brilliancy of the autumnal foliage.

Acer spicatum and *Acer pennsylvanicum* do not attain great size, but are beautiful in color of flower and fruit. The leaves of *Acer platanoides,* or Norway Maple, and *Acer pseudoplatanus,* or Sycamore Maple, resemble those of the Hard Maples in shape. They are larger and darker than the Hard Maples, and hang on the trees two weeks longer. The Norway Maple is extremely ornamental in flower, leaf, and fruit, and is often, and deservedly, planted as a specimen tree. *Acer negundo,* or Box Elder, is the only Maple with compound leaves. In fruit it is very attractive.

The Horse-Chestnuts may be used in many situations. The circle of leaves at the end of the twigs, supporting a pyramid of white blossoms, dashed with crimson and yellow, adds a charm to the landscape. In midsummer, after the early trees have bloomed, and some of the Maples, Elms, and other trees have shed their fruit, the cream-colored catkins of *Castanea dentata*—the Chestnut—burst into bloom. The trees, however, will be more thoroughly appreciated by the children when the first frost of the early autumn opens their prickly, velvet-lined burs, discharging the ripened nuts. It attains a great size, and its characteristic branches and twigs make it distinctive in winter.

Tilia americana, or American Linden, has

dense foliage, and produces dense shade. *Tilia heterophylla*, or White Basswood, has leaves with a silver-white under surface, and is very attractive in foliage. The Lindens have the added merit of very sweet perfume, and are attractive to bees.

One of the late-blooming trees is *Catalpa catalpa*. The large, silky, heart-shaped leaves and showy branches of flowers make it a desirable tree.

A tree that can adapt to itself and endure the poor soil common to many school yards, especially in the city, is the *Ailanthus glandulosa* —"Tree of Heaven." The foliage is tropical in appearance. The trees are dicœcious, flowers yellowish green, the staminate ones with an exceedingly disagreeable odor. In the autumn the pistillate trees are among our most beautiful, with their great masses of long, swaying compound leaves, surrounding the reddish yellow-green, full-fruit clusters, which are abundant.

No trees exceed the Poplars for rapid growth, but they can not be used alone with good results. A good plan is to plant them with Maples, Elms, Pines, or other slowly growing trees, and remove them as soon as they lose their beauty and the other trees are large enough to occupy the space. The fluttering leaves produce a lively effect when used with a mass of trees of other

varieties. *Populus nigra italica*, or Lombardy Poplar, is statuesque, and can be used with round-headed trees to diversify and accentuate the sky-line. They also make effective screens, and may be used to define the limits of a yard by planting them along the fences. Thus there will be the effect of trees without the shade of the spreading varieties. *Populus tremuloides*—Quaking Aspen—*Populus grandidentata*—Large-Toothed Aspen—which are so common and so available, may be planted for screens, and by keeping them trimmed there will always be a young growth, which will conceal the branches.

One of our most beautiful native trees is the *Liriodendron tulipifera*—Tulip-Tree—White or Yellow Poplar, as it is often incorrectly called. It belongs to the Magnolia Family, but has an individual beauty of its own. Its leaves, unusual in shape, and the large, brilliant, greenish-yellow flowers, with a dash of orange on each petal, strongly resembling a tulip, make it the perfection of symmetry and form.

The Oak is the most magnificent of the forest-trees. It is a king among trees, as the lion is king among beasts and the eagle among birds. It is the emblem of grandeur, strength, and duration. Its growth is slow, but the result repays for the waiting. *Quercus alba*—White Oak—has a magnificent, light, yellow-green foliage, and

delicate pink and white leaves in the spring, deep, shining green in midsummer, and rich dark purplish-red in autumn. The autumnal

Betula papyrifera: White, Paper, or Canoe Birch.

tints of the *Quercus coccinea,* or Scarlet Oak, are the most brilliant of the oaks.

Betula nigra: Red Birch.

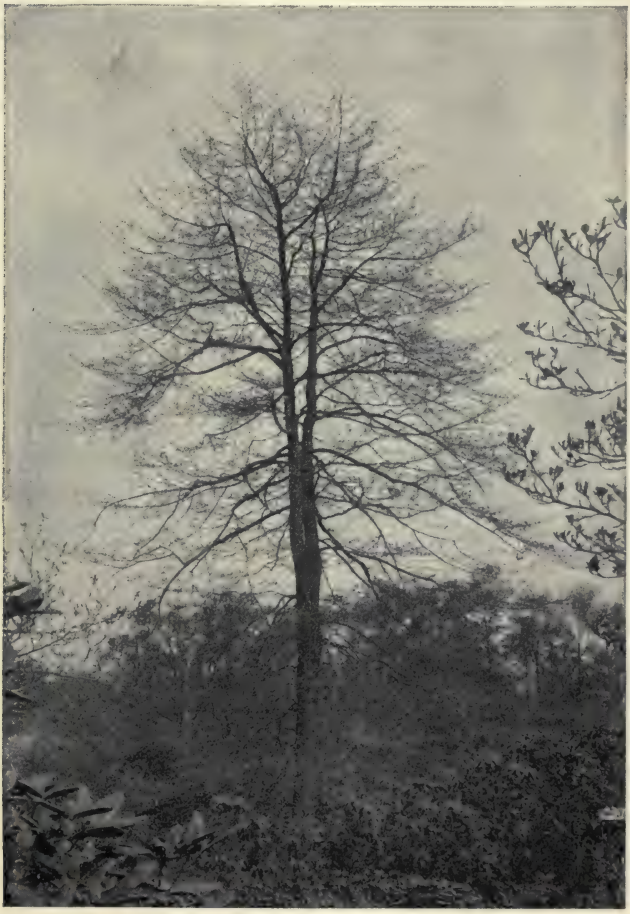
The Birch has been called "the most beautiful of the forest-trees—the Lady of the Woods." The grace and beauty of form and limb entitle

it to this distinction. The varieties of special value are *Betula populifolia*—White Birch; *Betula papyrifera*—Paper Birch; *Betula nigra*—Red Birch; *Betula lenta*—Sweet Birch! and *Betula lutea*—Yellow Birch. They are most desirable, and produce light, airy effects.

Alnus glutinosa, or European Alder, is very good in the spring, when it shakes out its golden curl. Hop-Hornbeam—*Ostrya virginiana*—and Blue Beech — *Carpinus caroliniana* — are very graceful and effective. One of the Leguminosæ, or Pea Family, is a tree of unique appearance and interesting character, the Kentucky Coffee-Tree—*Gymnocladus dioicus.* It is rare, but should be planted. Another interesting member of the Pea Family is the *Robinia pseudacacia,* or Locust. In flower and leaf it is an exceedingly graceful tree. It is planted to best advantage when massed with other trees, as the wood is weak, easily broken, giving the tree an irregular appearance.

The most striking effects may be produced in the fall by the Sweet and Sour Gums. The autumnal foliage of *Liquidambar styraciflua,* or Sweet-Gum, is a brilliant mass of rich red. The peculiar winged bark is unique, as are also the fruit-balls. *Nyssa sylvatica*—Tupelo, or Sour-Gum—is called the "Nymph of the Forest." The surface of the leaves is smooth and

glossy, and the superb autumn coloring is brilliant scarlet, dashed with orange. For gorgeous



Nyssa sylvatica: Tupelo, or Sour-Gum. "The Nymph of the Forest"

autumnal effects nothing can surpass in brilliancy the Maple, Dogwood, Sassafras, Liquidambar, and Tupelo.

The Ashes, *Fraxinus americana*—White Ash—*Fraxinus quadrangulata* and *nigra*—Blue and

Pyrus floribunda: Chinese Flowering Crab.

Black Ash—are of rapid growth, and excellent for large masses.

Pyrus coronaria—Fragrant Crab—and *Pyrus floribunda* fill the air with perfume in May or June. *Rhus hirta*—Staghorn Sumach—produces effective massing in autumn, with brilliant scarlet and yellow leaves and crimson velvet fruit. *Sassafras sassafras* often grows in dense thickets, the peculiar leaves turning a brilliant color in the fall. *Euonymus atropurpureus,* or

Burning-Bush, retains its bright-red fruit until midwinter. *Hamamelis virginiana,* or Witch-Hazel, almost forgets to bloom. After the other trees have prepared for winter, and its leaves are brown and falling, the yellow flowers burst into bloom, and give to the November woods a suggestion of summer sunlight.

Pinus strobus — White Pine — is the most stately and beautiful of all the conifers. The slender, silky, green needles make it very desirable for landscape effects. *Picea alba*—White Spruce—in growth and texture produces artistic contrasts with deciduous trees. *Tsuga canadensis,* or Hemlock, is more graceful than the Spruce, and being a shade-enduring tree, can be used for massing under other trees. *Larix laricina* and *Larix Europœa*—Tamarack and European Larch—grow best in moist situations. Foliage, cones, and catkins are exceedingly light and dainty in the spring. *Thuja occidentalis*—Arborvitæ—is used for hedges, and extensively cultivated as an ornamental tree. Its formal outline makes it useful in the architectural style of landscape-gardening. *Chamæcyparis sphæroidea*—White Cedar—*Juniperus communis*—Common Juniper—are statuesque in habit, and produce fine contrasts with the more freely growing trees and give accent to the landscape.

Salisburia adiantifolia—the Gingko-Tree—is

one of the most peculiar and beautiful trees, a native of China. The leaves are of a fine form, color, and texture. In the autumn they turn bright yellow, and hang on the trees a long time.

Salisburia adiantifolia: Gingko. Street Planting in Washington, D. C.

It is very extensively used, and richly deserves its popularity. It is rare in its beauty, peculiar in its growth, and especially adapted to street planting.

CHAPTER XIX

PRUNING OF SHRUBS

No single rule can be laid down as to the best method of pruning deciduous shrubs. The objects to be attained by pruning are the securing of some desired form, the development of strong, uniform plants and foliage, or the production of flower-buds.

A large percentage of the flowering shrubs blossom in the spring, and produce their blossom-buds on small branches that were made the year before. Each flower-bud is carefully protected from the severity of the winter, ready to develop with the warmth of the coming year. These are the branches which are sacrificed when the pruning is done in the autumn or early spring, and with them the buds and anticipated blossoms. If the pruning is delayed until after the shrubs have bloomed, they will make an effort to repair the waste by throwing out new shoots, which will ripen and prepare buds for next year's blossoms.

Shrubs that bloom in the summer or autumn on wood grown the same year endure severe pruning between late autumn and early spring. This treatment will destroy no flower-buds, but

will encourage a strong growth of flowering wood for the autumn.

Shrubs, as a rule, are in flower so short a time, comparatively, that the production of blossoms should not be the highest aim in their cultivation and treatment. A badly mutilated shrub loses much of the grace and charm of its foliage, and when the maimed twigs and branches are exposed in the winter much of their beauty is lost. Shrubs should never be so severely pruned as to impair their vigor and destroy the natural outline.

The thinning out and cutting back of weak, old, and diseased shoots gives the younger, more vigorous shoots more light, air, and space, and enables them to develop their best form. "Trimming shrubs into shape" can not be too strongly deprecated. The ideal is to encourage the best typical form.

Severe pruning tends to enfeeble shrubs, and the removal of large branches usually interferes with natural and graceful outlines. Generally, shrubs will be most vigorous and in their best form the year through when no pruning is attempted beyond removing weak and overshadowed branches, in order to afford the stronger ones a better opportunity for growth.

Pruning is one of the most important factors in the successful care of shrubs. It requires

great care and judgment, a thorough knowledge of the habit of growth of the plant, and should not be undertaken by any one who does not realize that the object of pruning is to develop whatever beauty each plant possesses on lines of its natural growth.

In the leafless season a mass of shrubbery is enveloped in a haze of delicate tints of violet, orange, buff, gray, and olive, a composite of the winter coloring of the twigs. The grace of form in shrubs is quite as distinct in winter as in summer, and should not be marred by ruthless pruning.

Some spring-flowering shrubs which should be trimmed after blooming or when in leaf:

Cornels,	Deutzia,
Diervilla,	Forsythia,
Ribes aureum,	Sambucus,
Viburnum,	Spiræa,
Kalmia,	Rhododendron,
Azalea,	Snowball,
Lilac,	Mock Orange,
Kerria japonica,	Berberis vulgaris.

Summer-flowering shrubs that should be pruned in winter or early spring:

Rosa rugosa,	Hydrangea,
Althea,	Tamarack,

Elder.

CHAPTER XX

PROPAGATION

Reproduction by seeds is the most common mode of propagation. The transfer of pollen is so easily effected by bees and other agents, and the results so beneficial, that horticulturists recognizing the advantage of cross-pollination or hybridization, as it is commonly called, by careful selection of parent plants, have succeeded in obtaining plants superior to both parents. The magnificent varieties of Chrysanthemums, Roses, Cannas, Tulips, Carnations, and Fruits are the result of hybridization.

Seeds as a rule produce the typical plant, but by careful selection and hybridization the species may be greatly improved and the seeds thus obtained often produce new types which are more valuable than the original. As there is a tendency to revert to the original type, better results are secured in propagating improved varieties by cuttings instead of by seeds.

Grapes and other improved varieties of plants are propagated by cuttings from stems. Out of several hundred plants from seeds there

may be only one or two which have the value of a new variety. The new plants may give great promise for a year or two, but soon develop traits that are so undesirable that their propagation is discontinued.

Potatoes are propagated by cuttings from thickened underground stems. The culture of potatoes has been for the production of tubers, and the floral parts have become reduced. However, they produce seed, though they are not apt to "come true to the seed."

The selection of seeds is very important. Reliable, tested seeds yield best returns and the products of large seeds have been found to be larger and marketable earlier than those from small seed.

In these days of adulteration, unless careful attention is given to the purity of seeds, many noxious weeds are introduced and become serious pests. Some of the most troublesome weeds are of European origin, Russian Thistle and Canada Thistle, while Pigweed, Ragweed, Burdock, Plaintain, Sheep-Sorrel, Shepherd's-Purse are very common.

Sample cases of seeds are prepared by the Government, which will aid in identifying different seeds. Such a collection could be easily made by the children in any community, and really be of more service. A careful record of

the purity of seed must be kept if the investigation is to be of any permanent value.

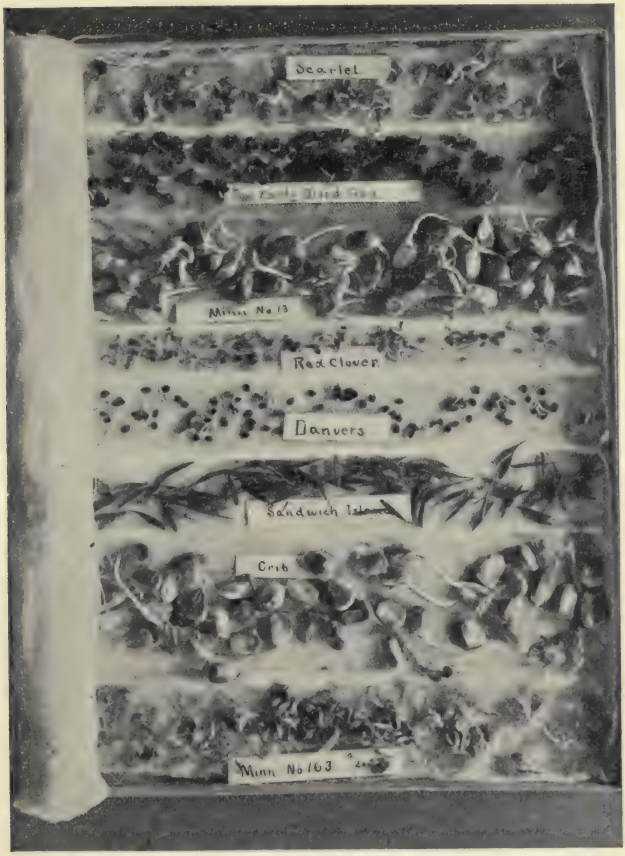
Seeds should be sown while as fresh as possible and for security should be thoroughly tested before planting. Several methods are recommended. One is to place them in water, those that sink being supposed to be good, while the bad ones remain on the top. This is not a conclusive test, as some seeds contain a great deal of oil and will float. A safe test is to cut a few of the seeds in pieces and examine the germinating organ, which appears white and plump if the seed is in good condition.

When the seeds are not adulterated they may be of such variable vitality as not to be desirable, especially for children, who expect that every seed put into the ground will do its duty and "come up." The proportion of seeds that is likely to grow can be readily determined with very little expenditure of effort.

Secure two germinating pans; two pieces of cotton flannel for each pan; glass for covering germinating pans; small paper labels and record-blank; and seeds to be tested.

"Count out one hundred of each of the different kinds of seeds selected for the garden—squashes, lettuce, radishes, carrots, beets, corn, beans, spinach and flower-seed. Wet the cloths, allowing them to get thoroughly soaked, and

wring out the surplus water. Spread one cloth in the bottom of the pan, woolly side down, and



Germinating Pan.

draw the cloth into as many folds as there are varieties of seed to be tested. Arrange the seed

in the folds and cover with the other cloth, woolly side up. Cover with glass and keep warm. Keep the pans moist, examine once in two days and remove all seeds that have made a good start. When the germination ceases, count all that have decayed and those that were dormant and carefully record the results. This will be an interesting lesson on the germination of seeds with a practical significance."

The vitality of seed is preserved by keeping them at a temperature of forty-five degrees, neither too wet, nor too dry. Some seeds must be sown as soon as they ripen, and most seeds within a year. Fall-ripened seeds are generally sown in the spring, and kept in a well-ventilated place all winter. Some seeds retain their vitality a number of years, as those of melons, pumpkins, squashes and cucumbers. They contain a great deal of oil, which passes through some chemical changes, which render it more available after the first year.

Nuts and hard seeds are usually put into the ground and the alternate freezing and thawing softens the integuments and causes the shell to open.

Biennials should be sown about the middle of spring, so that the young plants will be established before the winter and ready to bloom the following summer.

Square or rectangular seed-boxes, four inches deep, all the same size, must be prepared with good soil for the starting of seedlings in the spring. In these boxes, cabbage, lettuce, cauliflower, eggplants, tomatoes, and celery can be started for the vegetable garden, and Salvia, Marigold and other seeds for the flower-garden. When necessary, the plants must be carefully thinned. Some plants require several pickings-off to make them root more freely. With each succeeding picking off the soil must be made more substantial and nutritive. Seedlings are apt to "damp off" or be attacked by a fungous growth at the surface of the soil. A thin layer of silver sand sprinkled on the surface will prevent this, as fungi are unable to organize mineral matter into plant-food and the sand will not support them.

Next in importance to propagation by seed is the multiplication by cuttings. This may be done by taking parts of stems, root or root-stock or leaf.

Propagation by cutting is one of the most intensely practical and useful methods and consists of taking a portion of the stem, leaf or root of a living plant and placing it under such favorable conditions that it will root and form a new plant. By this means the type is preserved and propagation by seed often gives rise to unex-

pected varieties. Materials for cuttings should be taken from healthy plants only. Care must be observed in the selection of material. Choose the tips of branches, avoiding those which are too tender or too hard. A safe test is a stem which will break when bent. Make the cutting two or three inches long, as a larger one is apt

Cuttings.

to wilt. Use a sharp knife and make a clear, clean, diagonal cut, beginning under or opposite a leaf. Remove lateral leaves to reduce transpiration of moisture, and if the terminal leaves are large cut away portions of them for the same reason. Clean, sharp sand, containing no organic matter, thoroughly wet, and well-drained,

carefully firmed, makes the best propagating bed. When inserting a cutting it is desirable to make a hole with a pointed stick, called a "dibble," into which the cutting is placed and the soil carefully firmed around it.

Plant the cuttings near enough to economize space and avoid crowding—in rows three inches apart. The soil must never become dry or the cutting allowed to wilt. Thorough ventilation is necessary, but drafts must be avoided. Cuttings of roots or root-stocks are easily made. *Bouvardia, Anemone japonica,* respond to such treatment. *Anemone japonica* is a plant so satisfactory children should know it and how to cultivate it. Cannas and Dahlias are propagated by the division of root-stocks, as is also the Blackberry. *Rex begonia* is the best plant for illustrating propagation by leaf-cutting. It may be done by inserting the petiole of a leaf, or by using the whole leaf, weighting it in sand, and severing the larger veins, or dividing the leaf into several pieces and inserting the veins in sand. The young plants appear at the veins.

Cuttings required for spring planting may be propagated in winter, although as a rule cuttings strike better in the spring. Hardwood cuttings strike successfully in the autumn and winter and begin to grow in the early spring. They require a uniform heat, plenty of water

and air, proper shade and freedom from fungous growth. After rooting they must be put into small pots, and as soon as the roots appear at the bottom of the pot, or the ball of earth is covered with white roots the plant is ready for repotting. Small bulbs which develop from the majority of bulbous plants, as Tulips and Hyacinths, and the small corms produced by the Crocus and the Gladioli, are used for purposes of propagation. A common method of multiplication of the Strawberry is by stolons or by runners.

CHAPTER XXI

GRAFTING AND BUDDING

GRAFTING and *budding* are the most artificial methods of propagation, but very useful. These operations result in the improvement and the perpetuation of many of our ornamental and valuable varieties of trees and shrubs.

Grafting is the process of inserting a scion of two or more buds into a stock.

Budding is the process of inserting a single bud into the stock.

A *scion* is a portion of a plant which is mechanically inserted upon the same or another plant with the intention of having it grow.

The *stock* is a plant or part of a plant on which a scion or bud is set.

It is necessary to select for a stock a good, strong, healthy plant, well rooted and capable of providing food for the scion.

Grafting is practicable nearly all the year, but in most cases is performed in the spring during the season of greatest growth. To be successful it is necessary for the cambium layer of the scion and stock to meet as perfectly as possible. During this season the cambium layer lying between the wood and bark is simply a

mucilaginous substance, which heals and unites wounded surfaces. Later in the season the tissues are more highly differentiated, becoming more wood-like in structure, and the union between stock and scion is not so sure.

To prepare for grafting dig and store one or two year old stock in the fall. Cut scions in fall or winter before the buds swell in the spring. Previous year's growth is generally used and only healthy, well-formed buds should be selected. Store them in moss, sand or sawdust in a damp cellar.

Put a ball of No. 18 knitting-cotton for a few minutes into melted wax. The cotton is soon saturated with wax and becomes useful for rapid work. Grafting-wax is made by melting four parts of unbleached resin, two parts of beeswax and one part of beef tallow over a slow fire. When thoroughly melted pour the liquid into a pail of cold water, and when it is sufficiently cool to handle, pull it and work it until it is the color of light molasses-candy. Protect in oiled paper until used.

Whip-grafting is usually employed on stock one or two years old. Cut both scion and stock diagonally across, the cut surfaces being from one to two inches; make a vertical cleft in both and join the two by shoving the tongue of the scion into the cleft of the stock; secure the parts

firmly by passing a bandage of grafting-cloth around them five or six times, or a bandage of cloth and protect with wax.

Splice-grafting is used almost entirely for root-grafting. Make a diagonal cut as in the whip-grafting and secure the parts by winding

Whip-Grafting.

1, Stock; 2, scion; 3, diagonal cut; 4, tongue cut; 5, adjustment of scion and stock; 6, graft waxed; 7, graft tied.

a waxed string which is strong enough to be of service and one readily broken. Splice-grafting is used on tender and soft wood which will not admit of splitting.

Saddle-grafting is generally employed when a terminal bud is used and the scion is too small and weak to be cut for a tongue-graft. Cut the

end of the stock wedge-shaped, split the scion and adjust it upon the wedge.

Cleft-grafting is made by cutting the stock off squarely and splitting the top. Insert wedge-shaped scions into the cleft, being careful to adjust the cambium layers of stock and scion so that the union may be complete. The scions usually have three buds and are fitted in an oblique position with the buds even with the top of the stock. The contact of stock and scion must be perfect. The "stub" of the tree must be carefully and perfectly covered with wax and cloth to exclude rain, air and fungous growth, which would cause decay. The scions may be taken in the fall and preserved in sand, moss, or sawdust, as in the case of splice-grafting and whip-grafting, and the work done in the spring before the flow of the sap. This method is especially applicable to the improvement of old orchards.

Shield-budding is the method in general use, and is the inserting of a bud from a twig of this year's growth under the bark of a young stock and securely tied. The stock should be at least three-eighths of an inch in diameter, and the bud inserted as near the surface of the ground as is convenient, in order that the union may not be seen. For protection against the sun the bud is generally put on the north side of the stock.

CHAPTER XXII

SOIL

When children understand something of the nature, function, origin and general composition of soil, their gardening will have an added interest. The constituents of soil are mingled fragments of various kinds of rock material, organic matter of vegetable and animal remains, and crystals deposited from oversaturated solution of soil-moisture. The surface soil consisting of the top to the depth of six to twelve inches, to which the garden is most closely related, is composed of fine rock fragments, while the deeper portions compose the subsoil. The evolution of plants was coincident with the evolution of soil, and the evolution of plants made possible the evolution of animals—the organic remains of which have a close relation to the fertility of the soil. The soil is the scene of the greatest activity of life and energy. One of its most important uses is to act as the storehouse for water to be used by plants. The productiveness of soil is determined largely by the amount of water it can hold, the manner in which it is

held, and the facility and completeness with which a plant can use it. The physical conditions of soil are more important than the chemical conditions, as plant-food is not available unless in solution.

Humus in the soil is derived from decomposition of aquatic plants in swamps; from the conversion of peat-bogs into humus soil; and from the accumulation of organic matter along lake and seashore and river margins and its decomposition.

The most important chemical elements in the soil necessary to plants are oxygen, hydrogen, nitrogen, silicon, carbon, sulphur, phosphorus, aluminum, potassium, calcium, magnesium and iron.

Oxygen is found in combination with all elements named in more than half of all known rocks.

Carbon occurs in soil as part of all humus or organic matter and unites with calcium to form carbonates of lime; with oxygen to form carbon dioxid, which plays an important part in the solution of plant-food and is a plant-food in the atmosphere.

Sulfur occurs in the soil abundantly as calcium sulfate, gypsum or land-plaster, an important fertilizer. Sulfur is an important part of organic compounds.

Hydrogen in water is necessary for the absorption of mineral salts in the soil and the life processes of animals and plants.

Phosphorus occurs in the oldest known rocks and has been concentrated from the soil in tissues of plants and animals. Deposits of animal remains form valuable sources of commercial fertilizers.

Nitrogen, which is low in its chemical affinities, is most abundant in air as free nitrogen and least abundant in compounds in the earth's crust. It occurs in humus and decaying tissues of animals and plants, and is converted into nitric acid, which is soluble and available to plants.

Aluminum is abundant in the earth's crust and is a fundamental constituent of true clay derived from feldspar and mica.

Calcium and *magnesium* are indispensable to plant-food and collect largely in seeds of plants, as fruit and corn.

Potash is widely distributed as a constituent of feldspar, mica and kaolin beds. Potash, magnesium and calcium aid in the transfer of starch-forming parts to seed, root and tubers. Plants can not thrive in soil destitute of nitrogen, potash, calcium, magnesium and phosphorus.

A heavy clay soil allows the threading of roots with difficulty. A light sandy soil admits of an equitable distribution of roots. Light and

heavy soil refer to the ease of tillage, which is necessary to give the soil proper physical conditions and make the plant-food locked up in the soil available for plants. When a crop is harvested the elements secured from earth and air, locked up in the plant-tissue, are removed and the soil depleted to that extent, and fertility must be renewed. This may be done by proper tillage, application of pure mineral fertilizers, barnyard manures or green cover crops, which when plowed in will add humus to the soil. Nitrogen is the most important of all soil ingredients, and is most rapidly depleted by faulty management. It exists as free nitrogen in the soil, and is essential to the life of certain microscopic forms of plants, which use it and render it available to higher plants. It occurs temporarily in a transition state as ammonia and nitrous acid, which pass rapidly into nitric acid, from which most of the higher plants derive their chief supply. The humus in soil is supplied by roots of field-crops, especially clovers and the leguminous plants, and passes through a process of fermentation, supplying nitric acid, which is soluble and available to plants.

One of the chief sources of the supply of nitrogen is the free nitrogen-fixing bacteria, which infest the roots of leguminous plants. They are micro-organisms which settle on the

roots of plants congenial to them, causing the formation of tubercles. It is an association of organisms for mutual advantage—the plants supplying nourishment for the bacteria, and the bacteria supplying plants with nitrogenous compounds from the soil-air. Other plants are dependent for their nitrogen upon the nitric acid and ammonia in the soil. A large part of the nitric acid in the soil is a final product of the life processes carried on in the soil in the decomposition of manures and other organic matter. Ammonia, the odor of which is present during the fermentation of manures, is produced from the compounds of nitrogen in plant-issues and excretions of animals through action of certain bacteria. The same process takes place in the soil when organic matter decays. The ammonia is seized upon by nitrous ferments reducing it to nitrous acid, and the nitrous acid is seized upon by other bacteria converting it into nitric acid, in which form it is used by plants. When plants are used as food by animals, and animals by man, the circuit is extended.

The transfer of plant-food in solution is due to the capillary movement of the surface film of water around the soil-grains. The capillary water in contact with the soil-grain dissolves the surface molecules of mineral matter and nitrogenous compounds. The solution continues un-

til the water of the soil-film is saturated. The amount of plant-food in solution increases with the temperature and is moved from place to place by capillary water. Root-hairs of plants utilize portions of dissolved mineral matter and cause solution to go on at a more rapid rate. The process by which food-laden water enters root-hairs, rises in the stem, and into the leaves and sunshine above, is called *osmosis*.

When two liquid substances are separated by a membrane, through which these liquids can pass, the greater flow is toward the denser solution. A cucumber put into fresh water will become crisp, because the exchange of liquids is more rapid toward the cell-sap; put into strong salt water the cell-sap flows more rapidly into the dense salt water, and the cucumber shrivels. A cooked prune or raisin becomes plump for the same reason. If the water is consumed as plant-food or lost by evaporation or transpiration, the osmotic pressure at that point is diminished, and the flow from adjoining cells makes good the loss. Water acts as a medium through which mineral salts in solution are carried to different parts of the plants. The assimilated products are transferred to be stored in seeds, leaves, roots and stems, while the superfluous water passes into the air by transpiration and evaporation.

Large amounts of water are necessary to maintain the functions of plants due to rapid evaporation from the extreme exposure of foliage, and the physiological processes, which demand large movements of water in growing tissues. The water capacity of soil is an important factor in determining its value for gardening purposes. In general, the finer the soil-grain the more soil-water will be held, and the coarser the soil-grain, the greater the number of spaces larger than capillary size, the less soil-moisture will be held. It is necessary for the best results to give constant and careful tillage to secure the proper texture of soil. All water which the soil may contain is not available to plants. About half of their saturated amounts must be drained away before soil can contain enough air to maintain breathing of ordinary roots and germinating seeds. A thorough watering every few days is better than a slight application every day. To prevent evaporation the surface of the soil should be stirred to the depth of three inches to make an effective earth mulch. Firming the loose soil tends to increase moisture in surface soil at the expense of the deeper layers, and increases the rate of evaporation.

CHAPTER XXIII

FERTILIZERS

When a child has a garden, he wants a good one, and there is nothing more important to a garden than a good fertile soil. It should contain those elements which are found in plants and in such a form as to be available. When the soil is exhausted of these elements the deficiency must be supplied by an application of fertilizers. Potash, nitrogen and phosphoric acid exist in large amounts in plant-tissues and are most liable to be exhausted from the soil. Manures or fertilizers are applied to the soil for the purpose of increasing fertility; this is largely accomplished by supplying nitrogen; potash and phosphoric acid. There are two kinds of manures—farm-yard manure or other natural products and commercial fertilizers; their functions are twofold; they supply elements of plant-food and ameliorate the physical conditions of the soil. Clay and compact soils are made more open and porous by the application of natural manures; they admit air and water to direct contact with the dormant plant-food, which being acted upon,

is set free and made available. Light sandy soil has little water-holding capacity and is greatly improved by the use of natural manures; the organic matter occupies the open spaces of sand, making it more compact and more capable of holding water and plant-food in soluble form. Commercial fertilizers only supply plant-food, and do not improve the physical conditions of the soil. Their great advantage is that they are soluble and can be absorbed by the plants at once, while the nitrogen, potash and phosphoric acid in manures are largely insoluble and can not be used by plants until after decomposition begins.

Nitrogen is one of the most important constituents of fertilizers and one of the most expensive. When plants have a light, sickly appearance and their leaves are not in a good healthy condition, it is evident that there is a lack of nitrogen in the soil. Nitrates and ammonia are soluble and can be distributed through the soil in soil-moisture, being readily absorbed by the root-hair of plants. The supply of nitrogen is derived from dried blood, dried meat or animal matter, animal waste, dried garbage of cities; other animal products less useful are leather, wool, hair, cottonseed-meal, linseed-meal, waste from castor-oil beans after extraction of oils. Valuable sources of nitrogen are

guano, the excrement of sea-birds, obtained from the shore of Peru and the islands off that coast; sulfate of ammonia; and nitrate of soda—Chili saltpeter. Phosphates are derived chiefly from bones of animals, raw bones, bone-meal, bone-ash, and the mineral phosphates derived from the rock phosphates of South Carolina, Florida and Tennessee.

For school-garden purposes the soil should be thoroughly treated with a dressing of farm-manure which by decomposition will gradually be available for growing plants and maturing seeds. A complete commercial fertilizer contains nitrogen, phosphoric acid and potash, and will supply food to the plants before the manures are in proper condition for the purpose. It should be thoroughly mixed with the soil and not allowed to be in contact with the seeds and tender roots, as it will cause them to decay. A second or third application may be necessary, but it is bad management to apply large quantities at once—more than can be used by plants, as it is soluble, and may be lost by leaching away beyond the reach of the root systems. The little plantlet in the seed is supplied with organized plant-food stored in the seed for the purpose by the parent plant and utilized in developing root and stem. When roots begin to thread their way through the soil they absorb the soluble elements

supplied by the commercial fertilizers, and a strong system of leaves and stems is established. Natural manures contain all the elements of plant-food and will develop strong, vigorous plants and an abundant harvest. They are generally applied in a rotted or partially rotted condition. Horse manures are used for hotbeds, because of their heating qualities; and cow manure, mixed with soil, forms a good, rich potting earth. Nitrogen stimulates the vegetative systems and produces rapid growth and rich, dark foliage, while phosphoric acid produces well-developed plump seeds and fruits; potash increases bloom and intensifies color.

Compost properly prepared is an important adjunct to a garden. It is especially important for window-boxes and roof-gardens and for improving the soil of school grounds. It is made of sods, secured from a rich pasture or meadow, and piled in alternate layers of sod and manure. Organic waste matter from the garden may be used, such as garden litter, trimmings and fallen leaves. The compost heap must be turned several times to insure complete rotting, and if necessary thoroughly moistened with liquid manure.

Crops should be classified for purposes of fertilization and cultivation according to their period of growth. Trees and shrubs require a

long period for the development of leaves, stems and wood, and the quantity of flowers and fruit depends upon the efficiency of the work done by the vegetative parts. Potash, phosphoric acid and lime contribute to the growth and hardening of the wood and the maturing of the fruit. Sufficient nitrogen must be supplied to preserve vigorous, vegetative activity of trees and shrubs. Potash is most important to flowers and herbaceous plants, and in the form of ground bone furnishes phosphoric acid and nitrogen. Commercial fertilizers are concentrated forms of nitrogen, phosphoric acid and potash. Lime improves the physical condition of the soil, overcomes acidity and aids the plant in setting free unavailable plant-food.

Some plants are cultivated for their great development of leaves, as lettuce, spinach, Brussels sprouts, cabbage, celery and rhubarb; others, for their storehouses of nourishment, to be used for developing flowers and maturing seeds, as radishes, beets, turnips, parsnips and potatoes; others again are raised for their fruit or seeds, as cucumbers, squashes, pumpkins, melons, tomatoes, beans, peas and corn. Plants with large leaves, as cabbage, cauliflower, Brussels sprouts and lettuce, make a great demand upon the soil. They require nitrogen and phosphoric acid, and with light soils some potash. Care should be

taken not to use too much nitrogen at first, as the plants are liable to go to leaves, but after the head has begun to take shape the nitrogen may be applied in a form immediately available, as nitrate of soda.

Lettuce should be stimulated in its development by an abundant application of nitrogenous food. Sow seeds in rows one inch deep, twenty-five to fifty seeds to a foot, and cover with one-fourth to one-half of an inch of fine soil and firm with the hand or the hoe.

Radishes require rich friable soil, heavily manured and thoroughly mixed. The quick-growing varieties mature in from three to six weeks and should be used before they become pithy. Sow in drills an inch deep, ten to eighteen inches apart and cover with one-half of an inch of soil and carefully firm.

Peas should be planted as soon as the soil can be worked, in well-drained sandy soil, in double rows, in trenches four to six inches apart. Fill in the trench as the peas grow. In heavy soils the seeds should be within an inch of the surface. They acquire nitrogen through the agency of nitrifying bacteria and require phosphoric acid and potash. To secure a continued season of production, the vegetative parts, the roots, stem and leaves, must be stimulated by nitrogenous food.

Beans obtain nitrogen through nitrifying bacteria and must be supplied with phosphoric acid and potash in some form of manure.

Beets and *turnips* are developed by application of nitrogen and phosphoric acid.

Carrots require loose, friable, warm soil, well fertilized with barn manure and an application of some rapidly available potash fertilizer. Sow in rows one to two feet apart and thin from two to five inches.

Tomatoes are tropical and require a warm soil and climate and a sunny, open place in the garden. The plants are generally started under glass and when the weather permits are set out from three to five feet each way. The soil best adapted is heavily enriched barnyard manures, with a commercial fertilizer rich in nitrogen and potash worked into the soil at the time of planting.

Cucumbers and *squashes* thrive upon a rather compact clay soil, while *watermelons* and *muskmelons* require a light, warm, sandy soil. A continuous growth is desired, and the slow decomposition of farmyard manures will provide a continuous supply of plant-food. If commercial fertilizers are used they should be applied frequently. Too much nitrogen causes rapid growth and an abundant fruit of poor quality.

Corn makes heavy demands upon the soil.

To provide a sufficient amount of food the soil must be heavily treated with barnyard manure. Before planting put a small amount of commercial fertilizer in each hill and mix it thoroughly with the soil.

Potatoes require the greatest amount of potash and the least amount of phosphoric acid. Heavy application of manures produces good results. Thoroughly mix good commercial fertilizer in the hill or trench in which the potatoes are to be planted.

CHAPTER XXIV

INSECTS

When children begin their gardening they will find that plants have insect pests numerous and varied and difficult to combat. The corn bows to the cutworm; the potato yields to the Colorado beetle and wire worm; the squash-vine wilts with the borers; the tomatoes sacrifice their leaves to the caterpillars.

When we consider that four hundred million dollars' worth of the agricultural products of the United States is annually destroyed by insects; that the codling-moth alone demands a yearly tax of three million dollars from one State, the subject of economic entomology assumes great significance and should be more thoroughly understood, and means for keeping insect pests in check more thoroughly studied.

Many insects are injurious and many beneficial. Children are interested in them, and by practical experience in combating the harmful species will acquire much valuable information concerning them. It is important to distinguish between the injurious and the beneficial species

and determine the best means of destroying the one and protecting the other. The best means of combating insects must be determined by the manner in which they feed and by their life histories. Insects that have biting mouth-parts are destroyed by applying poison to the surface of the leaves upon which they feed. Those which have sucking mouth-parts must be treated by remedies applied to their bodies. The most difficult to reach are the borers; they work in the stems of plants and are most easily destroyed in the egg stage.

Some mechanical means of extermination are hand-picking for the tomato and other large larvæ and tree-borers and collecting and destroying eggs of the tent-caterpillar. Paris green, or some other poison, must be used in the case of insects which have biting mouth-parts; and lime, salt, sulfur, kerosene emulsion, or some other emulsion, is necessary for those insects which have sucking mouth-parts and which would not be affected by poison applied to the surface of the leaves. Some insects are controlled more easily in one stage of their life history than in another. It would be more simple to destroy a mass of tent-caterpillar eggs than the caterpillars that come from the eggs, or the moths that develop from the caterpillars.

To combat insects most effectually it is neces-

sary to have a knowledge of their life histories or metamorphoses. Some develop without metamorphosis. The stages are, egg, immature insect and adult; as, a silvery fishmoth. Many have incomplete metamorphosis. The stages are egg, nymph (several stages) and adult; as, locust, cricket, dragon-fly, damsel-fly, May-fly. Some of the most injurious insects have complete metamorphosis. The stages are, egg, larva, pupa, imago, or adult; as, moths, butterflies, bees, ants, beetles and flies.

There are nineteen orders of insects, only six of which are of great economic significance. These are Orthoptera, Hemiptera, Lepidoptera, Diptera, Coleoptera and Hymenoptera; they include some of the most numerous and destructive though interesting species.

Hordes of insects are destroyed by Nature's insecticides: the wind removes them from the trees; changes of temperature destroy many, because they can endure extremes but not variations in temperature; rain destroys plant-lice; fire makes havoc with insects in all stages, especially those infesting decayed wood; predaceous insects devour other insects; the air is cleared of gnats and flies by dragon-flies, and water-insects are destroyed by the scavenger-beetles; the ichneumon-flies deposit their eggs in the larvæ of other insects and in the mines of the engraver-

beetle. By removing the bark of trees the wonderful but destructive work of these beetles may be observed and studied. The praying-mantis is a unique variety which has interesting habits and destroys great numbers of other insects. Frogs and toads render great service in the garden and are wonderfully adapted by nature in the structure of the tongue for the work they do. All lady-bugs except one species are beneficial and should be protected. They destroy the San José Scale and other serious scale-pests and aphids. Birds prey upon the eggs, larvæ, pupæ and adult insects. They are natural enemies of insects, and the valuable work they do in keeping them in check is not sufficiently understood or appreciated.

CHAPTER XXV

SOME TREE PESTS

The children will find that trees, shrubs, vines, herbaceous plants and vegetables are attacked by many kinds of insects.

One of the attractive features of any city street or yard is the beauty of its shade-trees. In recent years some of the most beautiful and well-known shade-trees have been devastated by imported insects. To check their ravages sometimes requires an act of legislation, the support of public opinion, and much personal effort. It is in the power of school-children to do great service in forwarding this work. In one city children destroyed thousands of tent-caterpillar egg-masses, thus preventing the trees from being defoliated.

Galerucella luteola — European Elm-Leaf Beetle—is a serious menace to the Elm-Tree. It hibernates in large numbers in protected places, under roofs, shingles, clapboards and in empty buildings. In this stage it may be destroyed in great numbers. As soon as the buds of the Elm open, the beetles emerge and feed greedily upon

the young leaves, which soon become perforated. In about ten days the egg-laying begins, the female feeding and laying eggs alternately during a period of several weeks. The yellow spindle-shaped eggs are laid on the under surfaces of the leaves, from which the young larvæ emerge in a week's time and begin feeding upon the tender foliage. The great damage is done by the larvæ. When full-grown they are about half an inch in length, light yellow in color, with black markings arranged on the back to form two conspicuous stripes. When they are mature they drop from the tips of the branches and pupate in masses in sheltered places. The mature beetles emerge from the orange-colored pupæ in five to ten days and begin to feed upon the foliage. There are two broods a year. Repeated defoliation saps the tree of its vitality and the weakened condition invites the attack of other injurious insects—bark-beetles and borers—and the death of the tree is often the result. Two female beetles, observed for four weeks, laid respectively four hundred and thirty-one and six hundred and twenty-three eggs.

Orgyia leucostigma—Tussock Moth—severely injures the Elm, Linden, Horse-Chestnut, Silver Maple and other trees. Its increase is largely controlled by parasites. The eggs are laid by wingless females in late summer or autumn on

old cocoons, and are covered with a white froth which becomes hard and brittle. The larvæ hatch in the spring and attain maturity at midsummer. They are conspicuous and beautiful, with a characteristic black plume on each side of the head directed forward, and a similar one pointing backward from the posterior part of the body, and a row of short, dense tufts down the upper surface of the body. The loose yellow cocoon may be found in sheltered places on trees and fences. In two weeks the moths emerge and deposit eggs for the second brood.

Clisiocampa americana—Tent-Caterpillar—is responsible for the unsightly webs which are common in the spring, as those of the Fall Web-Worm are in the summer and autumn. The favorite food of this species is the wild cherry, although the apple, cherry and peach trees are frequently attacked. The compact brown egg-mass near the tips of the twigs is deposited in late summer and covered with a water-proof substance which protects the eggs during the winter. The eggs hatch early in the spring and the larvæ feed greedily on the opening buds and growing leaves. Unlike the Fall Web-Worms, which spin their webs at the ends of the branches, the Tent-Caterpillar selects a fork in the branches. The full-grown caterpillars, about the first or middle of June, crawl actively about

the ground along the fences and walls, seeking a favorable spot in which to spin their cocoons. The reddish-brown moths emerge in two or three weeks and fly by night to deposit their eggs.

Hypantria cunea—Fall Web-Worm—appears in late summer. The larvæ spin their webs on the tips of the branches and constantly enlarge them, as they generally feed under cover. The Butternut, Ash, Oak, Maple, Linden and Horse-Chestnut fall an equal prey. The larvæ when full grown are one-half to two inches in length, with yellow longitudinal markings, and are covered with grayish hairs. They go into pupation in September, and the white moths do not emerge until the following July. Their natural enemies are the Cuckoos and the Orioles, and they are parasitized by various ichneumon-flies.

Euvanessa antiopa—Spiny Elm Caterpillar, or "Mourning Cloak"—is the familiar dark brownish-purple butterfly with a cream-colored band on the edge with dashes of blue. The larva feeds upon the Poplar, Willow and Elm. It hibernates as the adult butterfly, and as soon as the leaves are fully grown the female lays eggs in clusters of from twenty to two or three hundred around the smaller twigs. The larvæ hatch in about two or three weeks and feed in companies on the tender portions of the leaves, and later on the veins. They mature in about four weeks

into caterpillars about two inches long, sprinkled with gray, with numerous red-marked, branched spines. They then leave the trees and in some protected place transform into the chrysalis stage from which the adult butterflies emerge in about two weeks. They have many natural enemies—the eggs and the larvæ are both parasitized.

Pulvinaria innumerabilis — Cottony Maple Scale—attacks the Maple-Tree and may be recognized by the soft brown scale and cottony mass which projects from it. The cottony mass is really a wax or glue, in which are embedded innumerable minute eggs from which the larvæ hatch and scatter in all directions. They insert their sucking tubes into the leaf or twig and begin the formation of a scale. They are sometimes very destructive.

CHAPTER XXVI

SOME COMMON GARDEN PESTS

Doryphora decem-lineata—Colorado Potato Beetle—is familiar to every child who has worked in a garden. It hibernates in the ground or in rubbish, and in the spring the female lays from five hundred to a thousand eggs, which hatch in from five to seven days. The grubs are full grown in two or three weeks and pupate in the ground. The beetles appear in ten days. As there are two or three broods a year, and both beetles and grubs feed ravenously upon the leaves, great care is required to keep them in check. Apply Paris green, dry, or as a spray.

Flea-beetles, which attack the leaves of potatoes and tomatoes, are small beetles which eat many holes through the leaves. Spray with kerosene emulsion or Bordeaux mixture.

The larva of the Sphinx-Moth—*Phlegethontius celeus*—is a serious enemy to the tomato-plant. It is very large and does great damage. It descends into the ground, where it transforms into the pupa and hibernates. It is subject to attacks of ichneumon-flies, and is often to be

found covered with white cocoons of the parasites.

Pieris rapæ, the Cabbage Butterfly, is another common pest in the garden. It is yellow with black markings. The male has one black spot on each fore wing, and the female two. The metamorphosis takes place in such a short time that it offers one of the best opportunities for studying the life history of an insect. There are several broods a year. The eggs are laid on the leaves. The green larvæ attain their growth in two weeks, and change into chrysalids from which the butterflies emerge in ten days. Spraying the leaves with poison is dangerous, and it is therefore better to destroy the butterflies, though this is not a pleasant thing to recommend.

Diabrotica vittata, the Striped Cucumber-Beetle, is a very familiar inhabitant of the garden. It seems to be waiting for the vines to come up, for as soon as the tiny leaves appear above ground the beetles are there ready for work. Paris green and tobacco-dust are effective remedies.

Anasa tristis—Squash-Bug—hibernates, appears in the spring, and lays eggs on the tender sprouts of squash and pumpkin vines, and sometimes entirely destroy them. Its near relative is the Stink-Bug, the creature which often gives to raspberries and other berries a disagreeable taste.

It has sucking mouth-parts and feeds upon the juices of the leaves, causing them to wilt and die. Destroy the adults and eggs and use kerosene emulsion, diluted, for nymphs and young bugs.

"Lady-bug, lady-bug, fly away home, your house is on fire; your children will burn;" so say the children, and if she is a well-behaved bug, she will spread her hard beetle wings and fly away. *Adalia bipunctata,* the Twice-Stabbed Lady-Bug, is a cunning, busy little body, and may be found crawling over trees and plants. Close observation will disclose that she is in search of Aphids, or Plant-Lice, which are so destructive, and of scale-insects, which do so much damage to trees. She is a very beneficial insect and should be carefully protected. Associated with the Lady-Bugs and Plant-Lice are Black Ants. They come on an entirely different errand. Aphids belong to the order of insects which have sucking mouth-parts and which feed upon the juices of plants. Ants have discovered that by stroking Aphids with their antennæ the Aphids give out drops of honey-dew, which the ants devour greedily. They have become so fond of it that they guard the Aphids very carefully and sometimes preserve them over winter. For this reason the Aphids have been called "ant-cows."

The Click-Beetle's acrobatic feats are known

to many boys and girls who do not realize that he spends part of his life in the ground as a yellow wire-worm—that long, slender, hard, yellow creature, feeding upon potatoes and the parts of plants growing beneath the ground. These worms should all be destroyed.

Calosoma calidium—the Fiery Hunter—and other ground beetles should be protected, as they are predaceous and destroy many injurious insects.

Lachnosterna fusca—May-Beetle—is one of the most destructive enemies to a lawn and to strawberry-plants. The eggs are laid among roots, and when hatched the grubs feed upon rootlets. They burrow in the ground in the winter, and do their feeding in the spring. When mature the grubs transform in earthen cells and appear in May and June as reddish-brown beetles that fly at night and are attracted by lights. They feed upon vegetation and sometimes do great damage.

Neumatus ribesii, the imported currant-worm, is the larva of the Saw-Fly, a yellow-bodied fly, somewhat resembling the house-fly. The eggs are laid on the under side of the leaves along the veins. The larvæ are exceedingly destructive and have the habit of curling the body around a stem or over the edge of a leaf. They attack the lower leaves first. There are two broods a year,

and if the bushes are treated early in the season with Paris green they may be kept in check.

Libellula basalis—Dragon-Fly—is predaceous, with mouth-parts formed for biting. The nymph-stage is passed in water as an ugly creature, which moves slowly about in search of food. As the nymph grows the wing-pads appear, and when fully developed the pupa stage has been reached. The creature, instead of being quiet, now moves actively, climbs upon some weed or rock, sheds its nymph-skin, and begins its life in the open air. Nothing is more wonderful in nature than this transformation. The dragon-fly is one of the beneficial insects, as it clears the atmosphere of mosquitoes, mites and gnats.

Cicada tibicen, the insect incorrectly called Locust, has a life history full of interest to children. They are all familiar with the peculiar shrill noise made by the male during the warm days of summer. The two drums by which this noise is made may be easily seen on the under side of the male's body. The discarded nymph-skins are commonly seen clinging to the trunks of trees and fences. But to watch the creature emerge from his nymph-skin, to see the undeveloped wings expand, and the delicate colors change to rich dull greens and browns, is a lesson in natural history that is not easily

forgotten. The drums of the male are interesting, but not more so than the ovipositor of the female with which she cuts slits in the bark of the twigs in which to deposit eggs. When the larvæ hatch they make their way to the ground, where they remain two years, sucking the juices from the roots of plants with the long sucking mouth-parts so plainly to be seen in the nymph and adult. A near relative, *Cicada septendecim,* retires to the earth for seventeen years and is called the Seventeen-Year Locust.

Papilio-polyxenes or *Asterias*—the Black Swallow-Tail—is the beautiful butterfly found flying among the flowers in search of nectar, giving in return for the feast of good things the transfer of pollen from one flower to another, and by this "cross-pollination," as it is called, helping to produce a good crop of seeds. It develops from the Fennel Caterpillar, which has green and black tranverse stripes and white dots. To protect himself, when disturbed, this larva protrudes two orange-colored horns, which give out a disagreeable odor and defends him from his enemies.

Anosia plexippus—the Monarch Butterfly—develops from another striped caterpillar that feeds upon the milkweed. Its chrysalis is one of the most beautiful in form—delicate light green, with gold dots. The male butterfly has

pockets on the hind wings, containing scent-scales, which are supposed to attract the females. It is an attractively colored and marked butterfly, but is not attacked by birds because it has a disagreeable taste.

Basilarchia archippus—the Viceroy Butterfly—has no means of defense, but by mimicry has taken on the color and markings of the Monarch, and thus escapes. It can be readily distinguished by the black crescent on the hind wing.

CHAPTER XXVII

BIRDS IN RELATION TO HORTICULTURE

THE importance of the study of birds in connection with school gardens is due to their dependence upon plants for food.

As the digestion, breathing, and blood-circulation of birds are extremely rapid, there is an enormous expenditure of vital energy, and great bodily exhaustion; consequently, a vast quantity of food is required to repair the waste. The food must be nourishing and concentrated, hence it consists largely of insects, fruit, and seeds, which afford the greatest possible amount of nutriment.

Birds are divided into orders and families, based upon their skeletal, muscular, and visceral characteristics; into genera by external characteristics—bill, feet, wings, and tail; into species and subspecies by color and size. The muscular and visceral characteristics are related to the kind of food; the bill, feet, wings, and tail to the manner of getting it; the color and size are for protection and attraction.

Birds are divided into seventeen orders.

The following are those orders of birds with which children are apt to come in contact, and which are most closely related to insect life:

Raptores—birds of prey—Vulture, Hawk, Owl.

Coccyges—Cuckoo, Kingfisher.

Pici—Woodpecker.

Machrochires—Goatsucker, Swift, Humming-Bird.

Passeres—Percher, Flycatcher, Bluebird, Blue Jay, Oriole, Sparrow, Finch, Swallow, Vireo, Warbler, Wren, Thrush.

If insects destroyed by birds were allowed to live they would have countless millions of descendants. The food of birds is varied and extensive, and often consists of articles most accessible. Each species attacks certain insects, and performs a service which can not be so well accomplished by any other species. Swallows, Swifts, Night-hawks, and Whippoorwills clear the atmosphere of insects. Flycatchers, Kingbirds, Pewees, and Phœbes capture their prey on the wing. Woodpeckers, Chickadees, Nuthatches, and Creepers explore the bark of trees for eggs, grubs, and ants. No form of attack is as effective as the destruction of eggs. Warblers and Vireos search diligently for the crawling prey among the trees. Blackbirds frequent the

swamps and meadows, seeking what they may devour. The Thrush Family—Robins, Bluebirds, Wilson, Hermit, and Olive-Backed Thrush—which are mainly insectivorous, prey upon grasshoppers, crickets, bugs, beetles, caterpillars, spiders and cutworms. Hawks and Owls industriously search meadow and marsh for voracious and destructive rodents. If left unmolested, birds would easily succeed in preserving the balance of nature. The most destructive animal enemies of plants are insects. Birds are extremely useful in keeping insects in check, and it is only necessary to inquire into the habits of the birds, and gain some definite information regarding the kind and quantity of their food, to realize the importance not only of protecting the birds, but of encouraging them to nest about gardens and orchards.

Woodpeckers render good service to fruit-growers and gardeners. They are of great economic importance, destroying insects that are destructive to trunks of trees. They are wonderfully constructed for the work they accomplish—toes arranged for clinging to the trunk of the tree; keen eyes; acute hearing; stiff tail-feathers, forming a support while at work; long, strong, chisel-like bill for removing bark; long, protrusive, and barbed tongue for removing grubs and insects. Downy and Hairy Wood-

peckers continue the search during winter. Much of the food of the Downy Woodpecker consists of ants, plant-lice, wood-borers, larvæ and adults of wood-boring coleopterous insects, beetles on foliage and bark, and caterpillars that bore into the trees or live on the leaves. They destroy the bugs that give berries a disagreeable taste, bark-lice, and scale-insects. The food of the Hairy Woodpecker is the same as that of the Downy. It destroys fewer ants, but feeds upon beetle larvæ, caterpillars, and winter hibernating insects and insect eggs. The Flicker, or Golden-Winged Woodpecker, eats an enormous number of ants, but fewer beetles and caterpillars. The food is secured largely from the ground, where his color makes him the least conspicuous of the woodpeckers.

Nuthatches and Creepers destroy an immense number of eggs and larvæ, examining every crack and crevice in the bark of trees. Woodpeckers run up the trees. Creepers run spirally from the base of the trunk to the top. Nuthatches run up or down or along the under side of a horizontal limb with equal facility, performing most interesting acrobatic feats.

The Yellow and Black-Billed Cuckoos are very valuable to the gardener. They destroy the larvæ of moths and butterflies, some of the most serious insect pests. They render the greatest

service to the gardener by destroying many insects that are not attacked by other birds. Their food consists of hairy caterpillars, tent-caterpillars, fall web-worms, tussock moths, and hosts of others, the worst enemies of plants. Nearly one-half of their food consists of caterpillars of various and most destructive species. They are shy birds, but if unmolested will frequent shade-trees in towns and cities. They are frequently known as "rain crows."

The Baltimore Oriole is one of our most attractive and beneficial birds. He seeks his food in the tree-tops. Much of his summer food consists of hairy caterpillars, noxious beetles, plant and bark lice.

Warblers flit from place to place among the trees in search of caterpillars and insects harmful to fruit and forest-trees. Multitudes of warblers of several varieties go through the orchards examining the rosettes of apple-leaves and blossoms for plant-lice.

The habits of the Vireos are similar to those of the warblers.

The Black-Capped Chickadee is small and unobtrusive in habits, but valuable in orchard and forest. All its food habits are beneficial, the food consisting of noxious insects, and especially of insect eggs, eggs of plant-lice, and such pests as common tent-caterpillars, forest tent-cater-

pillars, and fall canker-worms. In the winter it inspects trunks, branches and buds for insect eggs and hibernating insects.

Birds of prey are often regarded as harmful, but, with few exceptions, are exceedingly valuable. Hawks and Owls are the natural enemies of rabbits and mice. They bear the same relation to rabbits and mice that smaller birds bear to insect enemies.

The Cedar Waxwing, Catbird, and Robin are fond of cherries and small fruits. They eat more wild than cultivated fruit, and destroy many harmful insects, and probably do more good than harm.

A large number of one species of birds in any locality is apt to result in serious damage to crops. When the natural supply of food is exhausted, cultivated varieties are attacked. Birds are so important in keeping weeds and noxious insects in check that every effort should be made to protect them and secure their co-operation. The best results are secured by attracting a few individuals of many different species. There would thus be a demand for many different kinds of food, without an excessive demand for any one kind. Each bird has its place in the economy of nature and deserves encouragement and protection.

A study of the food of young birds is of the

greatest economic importance. The service rendered by birds is greatest when they are rearing their young. Most birds that feed upon fruit and seeds feed their young on insects. Nestlings can not digest hard substances, such as beetles and hard seeds, and their food must consist of soft-bodied insects, as caterpillars and other larvæ, grasshoppers, and spiders. The first week the young are fed almost entirely upon caterpillars and spiders. The food of nestlings has not been sufficiently understood, and the amount consumed not generally appreciated. The number of broods varies with species and regions. There is an average of two or three broods, of three to five each, in a season. Nestlings demand most constant and untiring industry on the part of their parents. They consume more than their own weight in a day, and make a daily gain in weight of twenty to fifty per cent. They are nearly all mouth and stomach, and spend almost all their waking hours in eating. It has been recorded that a robin ate sixty earthworms in a day. The kind and quantity of food of the different nestlings is of great importance, since many nests are placed in proximity to gardens, and the nestling season corresponds to the period when the depredation of insects is most destructive.

It has been found that the species of birds

having either animal or vegetable diet rear their young upon food similar to that which they themselves use. Gulls, Terns, Pelicans, Herons, and Kingfishers are fish-eating birds, and bring up their nestlings on fish. Hawks and Owls are birds of prey, and feed their young on birds and mammals. Insectivorous birds, as Cuckoos and Swallows, feed on nothing but insects. Exclusively graminivorous birds, such as Doves and Pigeons, feed only on starchy seed materials.

Birds that feed upon both animal and vegetable matter usually feed their nestlings entirely on insects, chiefly injurious kinds, as grasshoppers and cutworms. Many of our common birds are of this class. Seed-eating birds, and those that subsist on a mixed animal and vegetable matter composed largely of hard material, have powerful, muscular, grinding gizzards. Food of this kind resists digestion and requires to be broken up in the stomach. Birds that live on insects and vertebrates that are soft and easily digested have thin-walled, comparatively weak, non-muscular stomachs. Stomachs of newly hatched nestlings are, in most cases, merely membranous sacks, with comparatively little muscular development, and can not assimilate anything but the softest, most readily digested food.

Many birds that are largely vegetarians feed

their offspring on insects. The Crow Blackbird feeds plump spiders, tiny young grasshopper nymphs, and soft small cutworms for a while. Beetles soon become part of the fare, and when the Blackbirds are nearly or quite grown the stomachs are strong enough to digest corn. Corn is then given freely, and by the time they are ready to leave the nest it forms about one-fourth of their food.

The nestlings of Bluebirds are fed upon grasshoppers, and other insects, earthworms, and larvæ. The nestlings of Robins are fed from five to six times an hour with insect food —caterpillars, locusts, grasshoppers, crickets, beetles, May-beetles, cutworms, spiders, snails, and earthworms.

The House Wren is exclusively insectivorous, and is one of the most useful birds.

The feeding of the young of English Sparrows is of value, and many injurious insects are destroyed. The adults act as scavengers in the city.

The nestlings of the Baltimore Oriole are fed upon canker-worms; the Orchard Orioles upon May-flies, spiders, caterpillars, and grasshoppers.

The food of adult Crows is two-thirds vegetable, a large part of which is corn. The nestlings consume large quantities of cutworms, grass-

hoppers and May-beetles. The quantity of insect pests they consume exceeds in volume more than twice the corn they take. The first meal consists of grasshoppers, plump spiders, or soft cutworms. When two weeks old three-fourths of the diet consists of equal parts of beetles and flesh of vertebrates, fish, frogs, salamanders, turtles, snakes, birds, mice, and rabbits.

The Kingbird is one of the most beneficial birds. He destroys the asparagus-beetle, rose-beetle, flies injurious to stock, and insect pests not usually destroyed by other birds; kills honey-bees, but invariably selects the drones, and saves the young of game and poultry by driving away the crows and hawks.

The food of the nestlings of the Phœbe-Bird is insects. Three-fourths of the food consists of spiders, grasshoppers, caterpillars, and moths. The adult feeds upon beetles and some grasshoppers. The food of the nestlings of the Wood Phœbes is exclusively insectivorous—grasshoppers, flies, caterpillars and spiders. The nestlings of the Ruby-Throated Humming-Bird are fed largely on insects, and some sap and nectar from plants and flowers. The adult feeds upon gnats, ants, tiny bees, and parasitic wasps. The food is regurgitated by the adult.

Nestlings first feed on animal diet. This diet gradually changes when necessary. Animal

food is of most nutritive value, and most easily digested. It has been found that nestlings increase in weight from twenty to fifty per cent daily. At certain stages they require more than their own weight in insects every day. The food must be capable of rapid digestion, and readily obtainable. Spiders, grasshoppers, crickets, and caterpillars are the favorite food of the nestling of passeres or song-birds. Vegetarian birds, as the Crow, Catbird, Robin, Cedar-Bird, and English Sparrow, mingle fruit or grain in constantly increasing quantities with insect food. The hard beetles, dung-beetles, May-beetles, and weevils are substituted for the soft insects of the perching birds.

The amount of food required demands unremitting zeal on the part of the parents. The destruction of injurious insects is enormous, and results in the check of their increase.

One-tenth of the agricultural product of the United States is annually destroyed by the ravages of insects. To this must be added that caused by small rodents and harmful weeds. Mechanical and chemical aids are a necessity, but birds offer the simplest and least expensive help. These enemies of injurious insects are ever watchful, day and night, and deserve the greatest appreciation and protection.

CHAPTER XXVIII

TOOLS

Good garden tools are a necessity, and one of the most important lessons on gardening is the

Garden Tools.

proper care of tools. They should never be put away dirty or wet. Rubbing with vaseline prevents rusting. It is economy to buy good tools and care for them properly. The best is the cheapest.

Garden-line reel	$ .50
Garden-line 100 feet long	.50
Tape-line 50 feet long	.75
Gardening tools—rake, hoe and spade	1.25
Weeder	.15
Trowel	.15
Watering-can, 6 quarts	.60
Hedge-shears	1.50
Pruning-shears	1.00
Pruning-knife	1.00
Budding-knife	1.50
Grafting-chisel	.75
Grafting-mallet	.50
Grafting-wax, 1-pound package	.25
Cast-iron sun-dial	1.50
Bronze sun-dial	6.00

APPENDIX I

SHRUBS FOR THE ARBORETUM

LIST of native shrubs for the Arboretum with the following data: Scientific name; common name; height; distribution; time of blooming; kind of soil; color of flowers; color of fruit; autumnal coloring; remarks.

TAXACEÆ. Yew Family.

Taxus canadensis—American Yew. Low, straggling evergreen; Can., Va., Ia., Mich., Minn.; April and May; low, moist, shaded land; yellowish green; nut-like seed, enclosed in a red, pulpy, globulous, berry-like cup.

Taxus baccata—European Yew. Thirty–forty feet; Europe and Western Asia; April and May; in moist soil; yellow green, inconspicuous; scarlet, oblong berry; dark green, yellow-green undersurface; evergreen.

Juniperus communis—Common Juniper. Low tree; New Eng., Minn., Rocky Mts.; dry, sterile hills; common; inconspicuous; berries bluish black, whitish bloom; evergreen; endures poor soil.

BETULACEÆ. Birch Family.

Corylus americana—Hazel-Nut. Three–six feet; Me., Ont., Fla., Kan.; March and April before leaves; staminate flowers in drooping catkins, pistillate flowers in scaly bud;

dry, moist, or light soil; nut enclosed in involucre; dark yellow green above, and pale green finely tomentose beneath; dull yellow in autumn; useful for massing.

Betula pumila—Low Birch. Two–eight feet; Can., New Eng., Mich., N. J., O.; June, July; wet meadows; erect catkins; strobile dull; autumnal tints bright yellow; deserves cultivation.

Alnus incana—Speckled Alder. Eight–ten feet; Can., Penn., Neb.; April and May before leaves; along streams and in swamps; flowers in catkins; bright clear yellow in autumn; fruit like small pine-cones.

Alnus rugosa—Smooth Alder. Six–twelve feet; Mass., Fla., Minn., Tex.; March and April; along streams and in swamps; staminate and pistillate aments formed previous autumn; strobile of woody scales; yellow, touched with red; strobile red brown.

MYRICACEÆ. Bayberry Family.

Myrica gale—Sweet-Gale. Three–five feet; Can., Va., Minn.; April; low, wet places; staminate and pistillate flowers borne in catkins; dull yellow; leaves with resinous dots above and below; fragrant.

Comptonia peregrina—Sweet-Fern. One–two feet. Can., New Eng., Ga., Neb.; April and May; open spaces; in catkins, generally dicœcious; dull; foliage attractive; thrives in poor soil.

SALICACEÆ. Willow Family.

Salix discolor—Pussy Willow. Eight–fifteen feet; New Eng., Penn., west and south; March and April; moist or dry ground; flowers and fruit in catkins; catkins furry; smooth, bright green above, smooth beneath; responds to early spring warmth.

APPENDIX I

ELÆAGNACEÆ. Oleaster Family.

Elæagnus argentea—Silverberry. Six–twelve feet; Minn., S. D., Mont.; May and June; rocky, gravelly banks; silvery without, pale yellow within; drupe like; densely silvery on both sides; effective because of its metallic, silvery foliage.

Shepherdia argentea—Buffalo-Berry. Six–fifteen feet. Can., Minn., Kan., Neb.; April and May; rocky soil; yellow, dicœcious; silvery, stellate, pubescent above and below.

Shepherdia canadensis—Canada Buffalo-Berry. Three–eight feet; Can., Me., N. Y., Mich., Utah; April to June; gravelly, poor soil; yellowish; red or yellowish drupe; silvery stellate, pubescent above and smooth beneath; attractive in fruit.

LAURACEÆ. Laurel Family.

Benzoin benzoin—Spicebush. Six–fifteen feet; New Eng., west to Mich., south to Kan.; March and April; damp woods; greenish yellow; scarlet drupe; clear bright yellow; leaves, fruit, and bark aromatic.

THYMELEACEÆ. Mezereum Family.

Dirca palustris—Leatherwood. Two–five feet; Can., Va., Minn., Miss. to Gulf; April; moist, shady places; light yellow; reddish drupe; clear yellow; bark used by Indians for thongs.

Daphne mezereum—Spurge-Laurel. One–four feet; Can., Mass., N. Y.; April, before leaves appear; good garden-soil; rose purple; red drupe; flowers very fragrant.

Daphne cneorum—Daphne. One–two feet; cultivated; May; calcareous soil; rose purple; olive green, persistent; very attractive.

MAGNOLIACEÆ. Magnolia Family.

Magnolia glauca—Laurel Magnolia. Four–twenty feet; Cape Ann, N. Y., Penn., south; June to Aug.; swamps, moist ground; white; cone of brilliant red fruit; glaucous beneath; evergreen in south.

RANUNCULACEÆ. Crowfoot Family.

Xanthorrhiza apiifolia—Shrub Yellow-Root. Two–three feet; Penn., N. Y., Ky., south; April and May; shady banks of streams; prune colored, shading to brown; greenish yellow; bright yellow to reddish purple; light and shade enduring.

LEGUMINOSÆ. Pulse Family.

Amorpha fruticosa—False Indigo. Five–twenty feet; Miss. Valley; May to July; moist soil; borders of streams; violet purple; pod; pale yellow; produces good effects.

Robinia hispida—Moss-Locust. Three–eight feet; southern range, but hardy in north; May and July; wood-lands; rose colored; pod; stems and pods covered with bristly hairs; branches weak and easily broken.

Laburnum vulgare—Golden Chain. Ten–fifteen feet; introduced; May; cultivated; clear yellow; pods; trifoliate; prefers lime soil.

Colutea arborescens—Bladder Senna. Three–nine feet; introduced; June; cultivated; yellow; pods or bladders; foliage decorative; good for hedge.

OLEACEÆ. Olive Family.

Syringa vulgaris—Common Lilac. Five–ten feet; Atlantic to Pacific; May; tolerant of many soils; lilac and white; capsule dull green; hardy and ornamental; many beautiful cultivated varieties.

Ligustrum vulgare—Privet. Three–ten feet; native of Asia and Europe; May; endures poor conditions; white; small black berry; dark green, nearly evergreen.

Forsythia viridissima—Forsythia. Three–eight feet; introduced from China; April; cultivated; yellow; capsule; yellow green; drooping variety, Forsythia suspensa.

HAMAMELIDACEÆ. Witch-Hazel Family.

Hamamelis virginiana—Five–ten feet; general distribution; November; woodlands; yellow; woody pods; brownish yellow; charm of late blooming.

CORNACEÆ. Dogwood Family.

Cornus florida—Flowering Dogwood. Five–thirty feet; New Eng., Can., Fla., Mich., Mo., Tex.; May and June; dry woods; yellow green; scarlet; rose colored; shade enduring; most beautiful Cornel.

Cornus circinata—Round-Leaved Dogwood. Six–ten feet; Can., Va., Mo.; May and June; rich or sandy soil; white; pale blue or white drupe; dull yellow; endures shade; branches greenish, warty dotted.

Cornus sericea—Kinnikinnik or Silky Dogwood. Six–ten feet; Can., Fla., La.; May and July; wet soil; white; pale-blue drupe; dull purple to deep red; twigs purplish in winter.

Cornus stolonifera—Red-Osier Dogwood. Three–six feet; Can., Va., Kan., Neb.; June and July; wet places; cream white; white drupe; bronze purple, dark red, and orange; red stems in winter.

Cornus alternifolia—Alternate-Leaved Dogwood. Six–twenty feet; Can., Minn., Ga., Ala.; May and June; moist soil; white; deep blue or reddish stalks; dark green, pale beneath; stems and twigs green in winter.

Cornus alba—Red-Stemmed Dogwood. Three–ten feet; cultivated; May; moist soil; white; white fruit, very attractive; brilliant red stems in winter; incorrectly called cornus sanguinea.

BERBERIDACEÆ. Barberry Family.

Berberis vulgaris—Common Barberry. Three–ten feet; hardy in north; May and June; lime soil; yellow; bright-red berries; dull purplish green; attractive in flower and fruit.

Berberis aquifolium—Mahonia. Three–six feet; introduced from Pacific; May; good soil; yellow; blue berry; bronze tones; valuable shrub.

Berberis thunbergii—Thunberg's Barberry. Two–five feet; hardy; May and June; any good soil; yellow; bright-red berries; rich, brilliant red, orange and reddish purple; excellent for borders and screens.

MALVACEÆ. Mallow Family.

Hibiscus syriacus—Rose-of-Sharon. Aug. and Sept.; cultivated; rose and white; capsule dull; clear yellow; may be used for hedge.

ROSACEÆ. Rose Family.

Spiræa salicifolia—Meadow-Sweet. Two–five feet; Can., Ga., Minn., Wy.; July to Sept.; moist soil; white or pinkish; capsule; dull yellow or red; increases rapidly.

Spiræa tomentosa—Steeplebush. Two–three feet; Can., Ga., Kan., Minn.; July to Sept.; low ground; rose color; capsule; dark green; stems and under surface of leaves very woolly; improves with cultivation.

Spiræa thunbergii—Thunberg's Spiræa. Three–five feet; cultivated; May; rocky hillsides; white; capsule; purple

bronze, purple and scarlet; summer foliage pale green, light and airy; relieves heavy masses of shrubbery.

Spiræa prunifolia—Prune-Leaved Spiræa. Three–five feet; cultivated; May; good soil; white, double; no fruit; scarlet, orange and bronze; may be planted for summer and autumn foliage.

Spiræa van houttei—Van Hout's Spiræa. Three–five feet; cultivated; May; good soil; white; deep reds, purples, scarlet, and orange; most desirable shrub.

Opulaster opulifolius—Ninebark. Three–ten feet; Can., Ga., Kan.; June; river-banks; white; green and russet inflated pods; used for hedges; slender branches, burdened with fruit.

Kerria japonica—Corchorus. Three–five feet; cultivated; May; partial shade; yellow, double; no fruit; yellow green; stems brilliant green.

Rubus odoratus—Flowering Raspberry. Three–five feet; Can., Mich., Ga., Tenn.; May to Sept.; moist, shady places; rose purple; tiny red drupes; green; increases by underground stems.

Potentilla fruticosa—Shrubby Cinquefoil. One–four feet; Can., N. J., Minn., Ia.; June to Sept.; tolerates poor conditions; yellow; capsule; silky pubescent; margins revolute; used as undershrub.

Rosa setigera—Prairie-Rose. Six feet; strong shoots, ten to twenty feet in a season; Can., S. C., Fla., Wis., Neb., Tex.; June and July; deep, rich soil; pink; red hips; rose, dull red, purple bronze; plant on banks.

Rosa blanda—Meadow-Rose. One–four feet; Can., New Eng., N. Y., Ill., June and July; rocky places; pink; bright scarlet hips; pale green; stems dark red.

Rosa lucida—Dwarf Swamp-Rose. Three–six feet; Can., N. J., Penn.; June and July; moist soil; pink; red hips; bright shining foliage; brownish-red stems.

Rosa rubiginosa—Sweetbrier, Eglantine. Four–six feet; N. S., Va.; May to June; roadsides; pink; orange red to scarlet hips; leaves aromatic; massed shrubbery.

Rosa rugosa—Japanese Rose. Three–four feet; imported; May to October; any good soil; purple and white; large red hips; very decorative; good hedgerows.

Rosa wichuraiana—Japanese Trailing Rose. Six feet; rapid growth; introduced; June; any sandy or gravelly soil; white; fragrant; scarlet hips; fine dark-green foliage; good covering for waste places; half evergreen.

Pyrus arbutifolia—Red Chokeberry. Two–eight feet; Can., Fla., Minn., Ill., Mo., La.; May and June; swamps and wet woods; white or purplish; dull-red pome; rich, shining green; exceedingly ornamental.

Pyrus nigra—Black Chokeberry. Two–five feet; Can., Fla., Mich.; May; low, moist ground; white; shining black; shining green above; yellow green beneath.

Amelanchier canadensis—Shadbush. Ten–thirty feet; Can., Minn., Kan., La.; April and May; swamps and open woodlands; white; crimson or purplish; yellow; varieties differ in colors of opening leaves, one form red, another silvery white with brilliant scarlet bud scales and parts.

ANACARDIACEÆ. Sumach Family.

Rhus glabra—Smooth Sumach. Ten–fifteen feet; Can., Fla., Miss., Ariz.; June to Aug.; barren, rocky soil; green; velvety crimson; scarlet and orange; good for massing.

Rhus aromatica—Fragrant Sumach. Two–six feet; Can., Fla., Minn., La.; March and April; dry, rocky soil; greenish yellow; red drupe; orange and scarlet; used under shrubbery.

Cotinus cotinus—Smoke-Tree. Six–twenty feet; introduced; May; good soil; yellowish green; green to dull yellow and red; dull green; most attractive in fruit.

APPENDIX I

ILICINEÆ. Holly Family.

Ilex verticillata—Black Alder. Five–ten feet; Can., Fla., Wis., Miss.; June and July; low, moist ground; greenish white; fruit bright red, rarely yellow; dark green; one of the best hardy ornamental shrubs; prized for color of fruit.

Ilex lævigata—Smooth Winterberry. Five–ten feet; Me., Penn., Va.; May and June; wet ground; white; bright red orange drupe; bright yellow; fruit attractive.

Ilex glabra—Inkberry. Two–six feet; Mass., Miss., La.; June; sandy soil; white; black drupe; bright green; evergreen.

Ilex opaca—American Holly. Twenty–forty feet; Me., N. J., Miss., Fla., Tex.; June; moist woodlands; greenish white; berries dark scarlet; deep green; evergreen.

CELASTRACEÆ. Staff-Tree Family.

Euonymus obovatus—Running Euonymus. Low, straggling; Can., Penn., Ind., Ky.; April and May; low, wet places; purplish green; crimson capsule, discharging a scarlet aril; dull green, pale green beneath; good cover for waste places; will thrive in almost any soil.

Euonymous americanus—Strawberry-Bush. Two–six feet; N. Y., Fla., Neb., Tex.; June; low woods; yellowish or reddish green; crimson capsule, opening to discharge a scarlet-covered seed; bright green; valued for ornamental fruit.

Euonymous atropurpureus—Wahoo. Six–fourteen feet; N. Y., Wis., Neb., Minn., south; May and June; moist soil; dark purple; purplish scarlet, capsule covering a crimson-covered seed; pale yellow; fruit ornamental in autumn.

SAXIFRAGACEÆ. Saxifrage Family.

Hydrangea arborescens—Wild Hydrangea. Four–ten feet; N. J., N. Y., Fla., Tenn., Mo.; June, July; rocky, moist

places; pinkish cream; capsule; bright green above; strong, upright shrub.

Hydrangea paniculata grandiflora—Four–ten feet; Aug. to Oct.; cultivated; good soil; greenish to white and dull rose; no fruit; dark green; light green beneath; very decorative.

Hydrangea radiata—Erect shrub, four–eight feet; N. C., Tenn., Ga., Fla.; June and July; rich, moist soil; greenish white; fruit inconspicuous; leaves densely tomentose beneath; vigorous, hardy shrub.

Hydrangea paniculata—Shrub or small tree. Introduced from Japan; Aug. to Sept.; good, rich soil; panicles of whitish flowers, sterile ones changing to purplish; capsule; leaves pubescent; parent of Hydrangea paniculata grandiflora.

Philadelphus coronarius—Syringa, Mock-Orange. Six–twelve feet; introduced; May and June; cultivated; endures poor conditions; cream white, capsules; dull green to purplish; young stems pale golden brown.

Philadelphus grandiflorus—Large-Flowering Syringa. Six–twelve feet; introduced; May and June; easily grown; cream white; dull capsule; little change of color; last of spring flowering shrubs.

Deutzia gracilis—Bridal-Wreath. One–two feet; introduced; May; good soil; pure white; capsule; rough in texture; hardy shrub.

Ribes floridum—Wild Black Currant. Three–five feet; Can., Ky., Ia., Neb.; April and May; moist soil; greenish white or yellowish; deep bronze; attractive in flower and fruit.

Ribes aureum—Missouri Currant. Five–eight feet; Miss. Valley to Rocky Mts.; April and May; easily cultivated; yellow; black berry; yellow and red; hardy.

RUBIACEÆ. Madder Family.

Cephalanthus occidentalis—Button-Bush. Four–fifteen feet; Can., Fla., Tex. to Pacific Coast; July and Aug.; along streams and swamps; white; ball of small capsules; dull yellow; deserves cultivation.

ERICACEÆ. Heath Family.

Gaylussacia resinosa—High-Bush Huckleberry. One–three feet; Can., Minn., Ga.; May and June; rocky woods and swamps; greenish pink; black; scarlet, crimson, and orange; edible fruit.

Vaccinium corymbosum—High-Bush Blueberry. Five–ten feet; Can., Va., Minn.; May and June; swamps and low thickets; white to pale pink; generally blue with bloom; brilliant scarlet and orange; good for shrub borders.

Andromeda polifolia—Wild Rosemary. One–three feet; Can., N. J., Penn., Mich.; May and June; cool bogs; white and light pink; dull capsules; dull green, glaucous beneath; thrives under cultivation.

Andromeda floribunda—Mountain Fetter-Bush. Two–six feet; Alleghanies, Va., Ga.; April and May; moist hillsides; white; capsule; evergreen; irregular hedge.

Andromeda calyculata—Cassandra, Leather-Leaf. Two–four feet; Can., Ga., Mich., Ill.; April; wet meadows; white; capsule; covered with scaly dots; very early bloom.

Kalmia latifolia—Mountain-Laurel. Two–four feet; Can., Penn., Minn.; May and June; moist soil; white, pink, and red; capsule; stiff, evergreen leaves; effective in masses.

Kalmia angustifolia—Sheep-Laurel. One–three feet; Can., Penn., Minn.; May and June; moist soil; lilac purple; capsule; light green, pale beneath; poisonous to animals.

Azalea nudiflora—Wild Honeysuckle. Pinxter Flower. Two–six feet; Can., Fla., Ill., Mo., Tex.; April and May; swamps and rocky woods; flesh color to pink and purple; capsule; dull yellow; very attractive shrub.

Rhododendron calendulaceum—Flame-Colored Azalea. Four–fifteen feet; Penn. to Ga.; May; dry woods; orange, turning to flame color; capsule; light green, somewhat tomentose beneath.

Leucothoë racemosa—Swamp Leucothoë. Five–twelve feet; Mass., Fla., La.; May and June; swampy thickets; white bells; capsule; scarlet, purple, and orange; prized for autumn coloring.

Leucothoë catesbæi—Catesby's Leucothoë. Three–six feet; Va., Ga., Tenn.; April and May; banks of streams; white bell; capsule; dark, shining green above, paler green below; easily cultivated; hardy in Mass.

Rhodora canadensis—Rhodora. One–two feet; Can., New Eng., Penn.; April and May; cool bogs; purplish rose color; capsule; pale green, paler and glaucous and downy beneath.

Rhododendron maximum—Great Laurel. Shrub or tree; Me. to O.; N. Y. to Ga.; July; damp, deep woods; pale rose color or nearly white; evergreen.

Ledum latifolium—Labrador Tea. One–three feet; New Eng., Penn., Mich., Minn.; May and June; cold bogs and wooded hills; white; capsule; densely covered with brown wool beneath; evergreen.

CAPRIFOLIACEÆ. Honeysuckle Family.

Sambucus canadensis—American Elder. Five–ten feet; common in Northern States; June to August; moist, rich soil in open places; cream white; dark purple berry; dark green; pith white; golden-leaved variety.

Sambucus racemose—Red-Berried Elder. Two–twelve feet; Can. to Ga., west to Col., Cal.; April and May; rocky; dry soil; cream white; brilliant scarlet berries; dark green, paler green beneath; pith yellow; extremely ornamental.

Viburnum lantanoides—Hobble-Bush. American Wayfaring-Tree; low shrub; Can., N. C., Mich.; May and June; cold moist woods; white; coral red to purple drupes; brilliant red and orange; attractive at all seasons.

Viburnum opulus—High-Bush Cranberry. Four–ten feet; Can., Penn., Mich., S. D. and west; May and June; low moist soil; cream white; bright-red drupes; bronze purple and dark red; parent of common snowball.

Viburnum acerifolium—Maple-Leaved Viburnum, Dockmackie. Three–six feet; Can., N. C., Mich., Minn.; June; cool, rocky woods; cream white; crimson drupe, turning to purple; dull red, varying to rose color; often confused with young maples.

Viburnum dentatum—Arrow-Wood. Six–ten feet; Can., Ga., Mich., Minn.; June; low, moist ground; white; dark-blue drupe; bronze red; very ornamental shrub.

Viburnum cassinoides—Withe-Rod. Two–twelve feet; Can., Ga., Ala., Minn.; June and July; swamps and wet soils; white; dark-blue drupes; purple, turning to rich red; improves with cultivation.

Viburnum lentago—Sheepberry, Sweet Viburnum. Fifteen–thirty feet; Atlantic, Mo., Minn.; May; woods, and banks of streams; cream white; black; petioles long and margined; prominent stamens; give cyme a yellow appearance.

Viburnum prunifolium—Black Haw. Six–ten feet; N. Y., Mich., Kan., south; white; purple; moist soil; autumn foliage; bronze; blooms very early.

APPENDIX II

TREES FOR THE ARBORETUM

GYMNOSPERMÆ

PINACEÆ	PINE FAMILY
Pinus palustris	Long-Leaved Pine
Pinus strobus	White Pine
Pinus resinosa	Red Pine
Pinus tæda	Loblolly Pine
Pinus rigida	Pitch Pine
Pinus virginiana	Jersey Pine
Pinus echinata	Yellow Pine
Pinus laricio austriaca	Austrian Pine
Pinus sylvestris	Scotch Pine
Picea canadensis	White Spruce
Picea rubra	Red Spruce
Picea mariana	Black Spruce
Picea excelsa	Norway Spruce
Tsuga canadensis	Hemlock
Larix laricina	Tamarack
Larix europæa	European Larch
Abies balsamea	Balsam Fir
Taxodium distichum	Bald Cypress
Thuja occidentalis	Arborvitæ
Cupressus thyoides	White Cedar
Juniperus communis	Common Juniper
Juniperus virginiana	Red Cedar

TAXACEÆ	YEW FAMILY
Salisburia adiantifolia	Gingko-Tree

APPENDIX II

ANGIOSPERMÆ

BETULACEÆ	BIRCH FAMILY
Betula populifolia	White Birch
Betula papyrifera	Paper Birch
Betula nigra	Red Birch
Betula lutea	Yellow Birch
Betula lenta	Sweet Birch
Alnus glutinosa	European Alder
Ostrya virginiana	Hop-Hornbeam
Carpinus caroliniana	Hornbeam

CUPULIFERÆ	OAK FAMILY
Quercus alba	White Oak
Quercus minor	Post Oak
Quercus macrocarpa	Bur Oak
Quercus prinus	Chestnut Oak
Quercus acuminata	Yellow Oak
Quercus prinoides	Dwarf Chinquapin Oak
Quercus platanoides	Swamp White Oak
Quercus rubra	Red Oak
Quercus coccinea	Scarlet Oak
Quercus velutina	Black Oak
Quercus digitata	Spanish Oak
Quercus palustris	Pin Oak
Quercus ilicifolia	Bear Oak
Quercus marilandica	Black Jack
Quercus imbricaria	Shingle Oak
Quercus phellos	Willow Oak
Fagus atropunicea	Beech
Castanea dentata	Chestnut
Castanea pumila	Chinquapin

URTICACEÆ	ELM FAMILY
Ulmus americana	White Elm
Ulmus pubescens	Slippery Elm
Ulmus racemosa	Cork Elm
Ulmus alata	Winged Elm

URTICACEÆ	ELM FAMILY
Ulmus campestris	English Elm
Celtis occidentalis	Hackberry
Morus rubra	Red Mulberry
Morus nigra	Black Mulberry
Morus alba	White Mulberry
Toxylon pomiferum	Osage Orange
PLATANACEÆ	PLANE-TREE FAMILY
Platanus occidentalis	Sycamore
SALICACEÆ	WILLOW FAMILY
Salix nigra	Black Willow
Salix lucida	Shining Willow
Salix amygdaloides	Peach Willow
Salix bebbiana	Bebb Willow
Salix discolor	Glaucous Willow
Salix alba vitellina	White Willow
Salix fragilis	Crack Willow
Salix babylonica	Weeping Willow
Populus tremuloides	Aspen
Populus grandidentata	Large-Toothed Aspen
Populus heterophylla	Swamp Cottonwood
Populus balsamifera	Balsam
Populus balsamifera candicans	Balm of Gilead
Populus deltoides	Cottonwood
Populus alba	White Poplar
Populus nigra italica	Lombardy Poplar
JUGLANDACEÆ	WALNUT FAMILY
Juglans nigra	Black Walnut
Juglans cinerea	Butternut
Hicoria minima	Bitternut
Hicoria ovata	Shellbark Hickory
Hicoria laciniosa	Big Shellbark
Hicoria alba	Mockernut
Hicoria glabra	Pignut
LAURACEÆ	LAUREL FAMILY
Sassafras sassafras	Sassafras

APPENDIX II

LEGUMINOSÆ	PEA FAMILY
Robinia pseudacacia	Locust
Robinia viscosa	Clammy Locust
Cercis canadensis	Redbud
Gymnocladus dioicus	Kentucky Coffee-Tree
Gleditschia triacanthos	Honey-Locust
Cladrastis lutea	Yellowwood

SIMAROUBACEÆ	AILANTHUS FAMILY
Ailanthus glandulosa	Ailanthus

SAPINDACEÆ	MAPLE FAMILY
Æsculus glabra	Ohio Buckeye
Æsculus octandra	Sweet Buckeye
Æsculus hippocastanum	Horse-Chestnut
Acer pennsylvanicum	Striped Maple
Acer spicatum	Mountain-Maple
Acer saccharum	Sugar-Maple
Acer saccharinum	Silver Maple
Acer rubrum	Red Maple
Acer platanoides	Norway Maple
Acer pseudo-platanus	Sycamore-Maple
Acer negundo	Box Elder

ANNONACEÆ	CUSTARD-APPLE FAMILY
Asimina triloba	Papaw

MAGNOLIACEÆ	MAGNOLIA FAMILY
Magnolia glauca	Swamp Magnolia
Magnolia tripetala	Umbrella-Tree
Magnolia acuminata	Cucumber-Tree
Liriodendron tulipifera	Tulip-Tree

TILIACEÆ	LINDEN FAMILY
Tilia americana	Linden

ROSACEÆ	ROSE FAMILY
Prunus nigra	Canada Plum
Prunus americana	Wild Plum
Prunus pennsylvanica	Wild Red Cherry
Prunus virginiana	Choke-Cherry

ROSACEÆ — ROSE FAMILY

Prunus serotina ..... Black Cherry
Pyrus coronaria ..... Crab-Apple
Pyrus americana ..... Mountain-Ash
Pyrus aucuparia ..... European Mount'n-Ash
Pyrus sambucifolia ..... Elderleaf Mount'n-Ash
Cratægus crus-galli ..... Cockspur Thorn
Cratægus coccinea ..... White Thorn
Cratægus mollis ..... Scarlet Haw
Cratægus tomentosa ..... Black Thorn
Cratægus punctata ..... Dotted Haw
Amelanchier canadensis ..... June-Berry

CORNACEÆ — DOGWOOD FAMILY

Cornus florida ..... Flowering Dogwood
Cornus alternifolia ..... Alternate-Leaved Dogwood
Nyssa sylvatica ..... Tupelo

HAMAMELIDACEÆ — WITCH-HAZEL FAMILY

Hamamelis virginiana ..... Witch-Hazel
Liquidambar styraciflua ..... Sweet-Gum

OLEACEÆ — OLIVE FAMILY

Fraxinus americana ..... White Ash
Fraxinus pennsylvanica ..... Red Ash
Fraxinus lanceolata ..... Green Ash
Fraxinus quadrangulata ..... Blue Ash
Fraxinus nigra ..... Black Ash
Chionanthus virginica ..... Fringe-Tree

BIGNONIACEÆ — BIGNONIA FAMILY

Catalpa catalpa ..... Catalpa
Catalpa speciosa ..... Hardy Catalpa

EBENACEÆ — EBONY FAMILY

Diospyros virginiana ..... Persimmon

STYRACACEÆ — STORAX FAMILY

Mohrodendron carolinum ..... Silverbell-Tree
Mohrodendron dipterum ..... Snowdrop-Tree

APPENDIX III

FLOWERS FOR THE WILD GARDEN

Succession of Blooming

MARCH AND APRIL

Epigæa repens	Trailing Arbutus	Pink
Symplocarpus fœtitus	Skunk-Cabbage	Yellow
Caltha palustris	Marsh-Marigold	Yellow
Hepatica triloba	Hepatica	Lavender
Erythronium americanum	Dog's-Tooth Violet	Yellow
Sanguinaria canadensis	Bloodroot	White

APRIL AND MAY

Oakesia sessilifolia	Bellwort	Yellow
Anemone nemorosa	Wood Anemone	White
Anemonella thalictroides	Rue Anemone	White
Dicentra cucullaria	Dutchmen's Breeches	White
Dicentra canadensis	Squirrel-Corn	Pinkish
Saxifraga virginiensis	Early Saxifrage	White
Trillium grandiflorum	Large White Trillium	White
Trillium erythrocarpum	Painted Trillium	White
Trillium erectum	Wake-Robin	Purple
Trientalis americana	Starflower	White
Tiarella cordifolia	False Mitrewort, Foam-Flower	White
Mitella diphylla	Mitrewort	White
Actæa alba	White Baneberry	White
Actæ rubra	Red Baneberry	Red
Cimicifuga racemosa	Black Snakeroot	White
Gaultheria procumbens	Wintergreen	White

MAY

Viola pubescens	Yellow Violet	Yellow
Viola cucullata	Purple Violet	Purple
Viola pedata	Bird's-Foot Violet	Blue Purple
Viola blanda	Sweet White Violet	White
Polygonatum biflorum	Solomon's Seal	Yellow
Smilacina racemosa	False Solomon's Seal	Yellow
Maianthemum canadense	Maianthemum	(Yellowish White)
Clintonia borealis	Clintonia	(Greenish Yellow)
Arisæma triphyllum	Jack-in-the-Pulpit	Green
Sarracenia purpurea	Pitcher-Plant	Purple

MAY AND JUNE

Erigeron bellidifolius	Robin's Plantain	Pink
Houstonia cærulea	Bluet	Blue
Potentilla canadensis	Common Cinquefoil	Yellow
Phlox subulata	Moss-Pink	Pink
Aquilegia canadensis	Wild Columbine	Red
Cypripedium acaule	Moccasin-Flower	Pink

MAY, JUNE AND JULY

Goodyera pubescens	Rattlesnake-Plantain	White
Pyrola elliptica	Shinleaf	White
Chimaphila umbellata	Pipsissewa	White
Oxalis stricta	Yellowwood-Sorrel	Yellow
Hibiscus moscheutos	Rose-Mallow	Pink
Drosera rotundifolia	Sundew	White
Iris versicolor	Blue Flag	Blue
Œnothera biennis	Evening Primrose	Yellow
Geranium maculatum	Wild Geranium	Purple
Geranium robertianum	Herb-Robert	Purple

APPENDIX III

MAY, JUNE, JULY AND AUGUST

Cornus canadensis	Bunchberry	White
Mitchella repens	Partridgeberry	White
Coptis trifolia	Goldthread	White
Capsella bursa-pastoris	Shepherd's Purse	Green
Brassica nigra	Wild Mustard	Yellow
Phlox maculata	Sweet-William	Pinkish Purple
Taraxacum officinale	Dandelion	Yellow
Medeola virginica	Indian Cucumber-Root	White
Hypericum perforatum	St.-John's-Wort	Yellow

JUNE, JULY AND AUGUST

Melilotus alba	White Sweet Clover	White
Trifolium agrarium	Yellow Clover	Yellow
Lilium canadense	Yellow Field-Lily	Yellow
Lilium superbum	Turk's-Cap Lily	Yellow
Lilium philadelphicum	Wild Red Lily	Orange
Rudbeckia hirta	Black-Eyed Susan	Orange
Verbena hastata	Blue Vervain	Blue
Calla palustris	Water-Arum	White
Asclepias cornuti	Milkweed	Pink
Monarda didyma	Oswego Tea	Red
Chelone glabra	Turtle-Head	White
Thalictrum polygamum	Tall Meadow-Rue	White
Lysimachia quadrifolia	Four-Leaved Loosestrife	Yellow
Brunella vulgaris	Self-Leal	Bluish Purple
Impatiens pallida	Jewelweed	Yellow

JULY TO OCTOBER

Linaria vulgaris	Toad-Flax	Yellow
Achillea millefolium	Common Yarrow	White
Lobelia inflata	Indian Tobacco	Blue or Purple
Lobelia cardinalis	Cardinal-Flower	Brilliant Red

JULY TO OCTOBER (*continued*)

Henanthus giganteus	Wild Sunflower	Yellow
Tanacetum vulgare	Tansy	Yellow
Daucus carota	Wild Carrot	White
Verbascum thapsus	Mullein	Yellow
Cichorium intybus	Chickory	Blue
Saponaria officinalis	Bouncing-Bet	Pinkish Purple
Inula helenium	Elecampane	Yellow
Epilobium angustifolium	Fireweed	Pink
Eupatorium purpureum	Joe-Pye-Weed	Rose Pink
Eupatorium perfoliatum	Boneset	White
Solidago juncea	Goldenrod	Yellow
Solidago lanceolata	Linear-Leaved Goldenrod	Yellow
Solidago cæsia	Blue-Stemmed Goldenrod	Yellow
Solidago bicolor	Silver-rod	White
Aster ericoides	White Heath Aster	White
Aster umbellatus	White Aster	White
Aster novæ-angliæ	New England Aster	Violet Purple
Aster puniceus	Swamp Aster	Lavender
Aster spectabilis	Purple Aster	Purple
Aster corymbosus		White
Aster cordifolius	Bluewood Aster	Pale Blue to White
Gentiana crinita	Fringed Gentian	Blue
Gentiana andrewsii	Closed Gentian	Blue to Purple

APPENDIX IV

NATIVE FERNS

Onoclea sensibilis	Sensitive Fern
Osmunda cinnamomea	Cinnamon Fern
Osmunda regalis	Royal Fern
Osmunda claytoniana	Interrupted Fern
Pellaea gracilis	Slender Cliff-Brake Fern
Pellaea atropurpurea	Purple Cliff-Brake Fern
Aspidium acrostichoides	Christmas Fern
Pteris aquilina	Brake
Adiantum pedatum	Maidenhair Fern
Asplenium felix-foemina	Lady-Fern
Asplenium ebeneum	Ebony Spleenwort
Camptosorus rhizophyllus	Walking-Fern
Woodwardia virginica	Virginia Chain-Fern
Aspidium fragrans	Fragrant Shield-Fern
Polypodium vulgare	Common Polypody
Phegopteris polypodioides	Long Beech-Fern
Phegopteris hexagonoptera	Broad Beech-Fern
Cystopteris bulbifera	Bulblet Bladder-Fern
Cystopteris fragilis	Common Bladder-Fern
Woodsia ilvensis	Rusty Woodsia Fern

APPENDIX V

BULBS FOR FALL PLANTING

Choice Varieties

	Each	Doz.	100
Single Mixed Hyacinths	$0.06	$0.65	$5.00
Double Hyacinths	.07	.70	5.50
Grape Hyacinths	.01	.12	.60
Mixed Single Tulip	.02	.20	1.00
Double Mixed Tulips	.03	.25	1.25
Single Jonquil	.02	.15	.85
Poets' Narcissus	.02	.15	.85
Mixed Flowering Crocuses	.01	.10	.50
Freesia, Large	.03	.25	1.50
Mixed Japanese Iris	.15	1.50	10.00
Mixed German Iris	.10	1.00	7.00
Lilium auratum	.12	1.25	9.00
Lilium candidum	.12	1.25	9.00
Lilium longiflorum	.07	.75	5.00
Lilium speciosum album	.15	1.50	12.00
Lilium speciosum rubrum	.15	1.50	17.00
Gladioli	.06	.60	4.00

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